USER MANUAL

INSTALLATION AND OPERATION

RECEIVER CONTROL UNIT
MODEL RCU-400A

TEN-TEC, INC.
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003	7-28-10	Para 7.6.1, page 7-22, Mission Download command word description	J. Andem

WARNING

HIGH VOLTAGE

Is used in the operation of this equipment.

DEATH ON CONTACT

may result if personnel fail to observe safety precautions.
Learn the areas containing high voltage within the equipment.
Be careful not to contact high voltage connections when installing, operating or maintaining this equipment.
Before working inside the equipment, turn power **OFF** and ground points of high potential before touching them.

PN 74436

TABLE OF CONTENTS

PARAGRAPH **PAGE**

LIST OF ILLUSTRATIONS..... iv

LIST OF TABLES..... v

1.0 INTRODUCTION
1.1 Purpose, Scope and Content..... 1-1

2.0 GENERAL INFORMATION
2.1 RCU-400A Purpose and Function..... 2-1
2.2 Specifications..... 2-3
2.3 Environmental Conditions..... 2-5
2.4 Mechanical..... 2-5
2.5 Electrical..... 2-6

3.0 PREPARATION FOR USE AND INSTALLATION
3.1 Unpacking and Inspection..... 3-1
3.2 Mounting..... 3-1
3.3 Power..... 3-2
3.4 Rear Panel Connections..... 3-2
3.4.1 Power Cable..... 3-2
3.4.2 External Reference..... 3-2
3.4.3 Audio Connections..... 3-2
3.4.4 Remote Control Connection..... 3-2
3.4.5 Connection to RX-400A Receivers..... 3-3
3.5 Configuration Dip Switch..... 3-6
3.6 Fuse..... 3-6
3.7 Front Panel Controls and Displays..... 3-6
3.7.1 Power Switch..... 3-6
3.7.2 Tuning Knob..... 3-6
3.7.3 Push Buttons..... 3-7
3.7.4 LCD Display..... 3-7
3.7.5 Volume Control..... 3-7
3.8 Headphones Jack..... 3-7
3.9 Chassis Ground..... 3-7
3.10 Typical RCU to RX Connections..... 3-7

4.0 OPERATION
4.1 Power ON/OFF..... 4-1
4.2 Headphones Volume..... 4-1

TABLE OF CONTENTS, cont'd

PARAGRAPH **PAGE**

4.3 Configuration Switch Settings..... 4-1
4.4 Detailed Operating Instructions..... 4-1
4.4.1 Front Panel Overview..... 4-2
4.4.1.1 Control Functions..... 4-3
4.4.2 Initial Configuration Upon Power Up..... 4-4
4.4.3 Factory Set Defaults..... 4-6
4.4.4 Operation..... 4-6
4.4.4.1 Manual Tuning..... 4-7
4.4.4.1.1 Step Size..... 4-7
4.4.4.1.2 Using the FREQ Button..... 4-7
4.4.4.2 Using the Arrow<> Keys..... 4-9
4.4.4.3 Detection Mode..... 4-9
4.4.4.4 Bandwidth..... 4-9
4.4.4.5 RF Gain and Squelch Settings..... 4-10
4.4.4.6 AGC Settings..... 4-10
4.4.4.7 BFO Operation..... 4-11
4.4.4.8 The Menu Key..... 4-11
4.4.4.9 Setting Up F1-F2 Frequency Scan Mode..... 4-13
4.4.4.10 Scan Mode Operation..... 4-15
4.4.4.11 Setting Up Memory Scan Mode..... 4-17
4.4.4.12 Memory Channel Scan Operation..... 4-18
4.4.4.13 Local and Lock Buttons..... 4-19
4.4.4.14 MIS Soft-key Function..... 4-19

5.0 THEORY OF OPERATION
5.1 Overview..... 5-1
5.2 Circuit Descriptions..... 5-2
5.2.1 Logic/DSP Section..... 5-2
5.2.2 Ethernet Switch..... 5-2
5.2.3 Serial Interface..... 5-2
5.2.4 Display and Keyboard Section..... 5-3
5.2.5 Power Supply..... 5-3

5.0 FIRMWARE LOAD AND UPDATE PROCEDURES
6.1 Introduction..... 6-1
6.2 Required Application Tools..... 6-1
6.3 Firmware Load/Update Steps..... 6-1

7.0 RECEIVER CONTROL UNIT INTERFACES
7.1 Introduction..... 7-1
7.2 Ethernet LAN Interface Description..... 7-1
7.2.1 Communications Protocols..... 7-2
7.3 Command Message Formatting..... 7-2
7.4 Terminators for Commands and Queries..... 7-2
7.5 Query Response Formats..... 7-3
7.6 Control Parameters..... 7-3
7.6.1 Command Descriptions..... 7-5

8.0 AUDIO STREAMING
8.1 Radio Over IP (RIP) Data Format..... 8-1

9.0 MAINTENANCE
9.1 Factory Service..... 9-1
9.2 Cleaning and Lubrication..... 9-1
9.3 Inspection..... 9-1
9.4 Performance Verification and Fault Isolation..... 9-1

10.0 PREPARATION FOR SHIPMENT OR STORAGE
10.1 Storage..... 10-1
10.2 Shipment..... 10-1

Important Operational Note..... 4-19

LIST OF ILLUSTRATIONS

FIGURE	TITLE	PAGE
2-1	RCU-400A Front View	2-1
2-2	RCU-400A Rear View	2-2
2-3	RCU-400A Three View Drawing	2-4
2-4	RCU-400A Electrical Interface	2-6
3-1	RX-400A & RCU-400A Rack Assembly	3-3
3-2	RX-400A & RCU-400A Installation	3-4
3-3	RCU/RX Interconnections	3-7
4-1	Control Convention	4-1
4-2	Front Panel Overview	4-2
4-3	IP Address	4-5
4-4	Power-Up Display	4-5
4-5	Power-Up Factory Default Settings	4-6
4-6	Manual Tuning	4-7
4-7	Manual Tuning Flow Chart	4-8
4-8	RX Address	4-11
4-9	Gateway Address	4-12
4-10	RCU Address	4-12
4-11	BIT Screen	4-13
4-12	Scan; F1, F2, FS Entry	4-14
4-13	Gaze, Dwell and Dead-time	4-15
4-14	F1-F2 Scan Mode	4-16
4-15	F1-F2 Scan Mode Flow Chart	4-16
4-16	Memory Channel Scan Mode Set-Up	4-18
4-17	Memory Channel Scan Mode	4-19
4-18	Memory Channel Scan Mode Flow Chart	4-20
5-1	RCU-400A Block Diagram	5-1

LIST OF TABLES

TABLE	TITLE	PAGE
2-1	Specifications	2-3
2-2	Environmental Conditions	2-5
2-3	RCU-400A Power Requirements	2-6
3-1	RM-400-2 Rack Mount Kit Contents	3-1
3-2	RX-400A Audio Connections	3-5
4-1	Control Functions	4-3
4-2	Arrow Key Functions	4-9
4-3	Scan Mode Set-Up	4-13
4-4	Memory Channel Scan Mode Set-Up	4-17
7-1	Baud Rate Switch Settings	7-1
7-2	Command Parameters	7-3

CHAPTER 1

1.0 INTRODUCTION

1.1 PURPOSE, SCOPE AND CONTENT OF USER MANUAL

This manual provides installation and operation instructions as well as pertinent technical data for the RCU-400A Receiver Control Unit. The manual was prepared using MIL-STD-1221, Department of Defense Handbook for Evaluation of Commercial Off-The-Shelf (COTS) Manuals as a guideline. It is organized into Chapters along with a Table of contents, List of Illustrations, and List of Tables.

Chapter 2 presents general information about the RCU-400A Receiver Control Unit (RCU) including functional capabilities, performance specifications and physical characteristics.

Chapter 3 provides information concerning the unpacking, inspection and mounting of the RCU. This chapter also provides instructions for making connections to the RCU as well as identifying the use and location of front panel controls and displays, and chassis mounted components.

Chapter 4 provides detailed step-by-step operating instructions, with illustrations, for all modes of Receiver Control Unit (RCU) front panel functions.

Chapter 5 provides a brief theory of operation to provide the User with a working knowledge of the RCU.

Chapter 6 contains the information and steps required to initially load or update the RCU Firmware.

Chapter 7 Provides the User and System Manager with the data necessary to effect remote control of the RCU to include interface description, message formatting and command descriptions.

Chapter 8 describes the Audio Streaming function.

Chapter 9 provides maintenance information.

Chapter 10 gives instructions to prepare the RCU for storage or shipment

2.0 GENERAL INFORMATION

2.1 RCU-400A RECIVER CONTROL UNIT PURPOSE AND FUNCTION

The TEN-TEC RCU-400A Receiver Control Unit (RCU) provides manual control for the RX-400A HF/VHF/UHF Receiver. The RCU may be co-located with a receiver using a side-by-side RM-400-2 rack mount kit, or remotely located to another position convenient to the operator. The RCU-400A can control one (1) to seven (7) receivers.

The unit is designed for fixed site, transportable, airborne and shipboard applications where the front panel controls may be operated easily with gloved hands. The panel layout uses large menu driven pushbutton keys and a 'multi-pot' shaft encoder to control receiver functions. A blue backlit LCD display presents the selected receiver's frequency, detection mode, IF bandwidth, signal level, gain, AGC mode, step size, threshold and F1-F2/memory channel scan modes. A Built-In-Test (BIT) screen is provided to report receiver status.

Control interface from the RCU to the RX-400A receiver or receivers is via Ethernet using an internal 'smart switch'. A digital audio stream from the receiver is also passed over the Ethernet connection to the switch. For mission downloads from an external host PC or workstation, using the MDL (Mission Down Load) software package, the RCU is connected to the LAN using the Ethernet port. Headphones audio is available on a front panel jack and analog line audio for the selected receiver is provided on a rear panel connector.

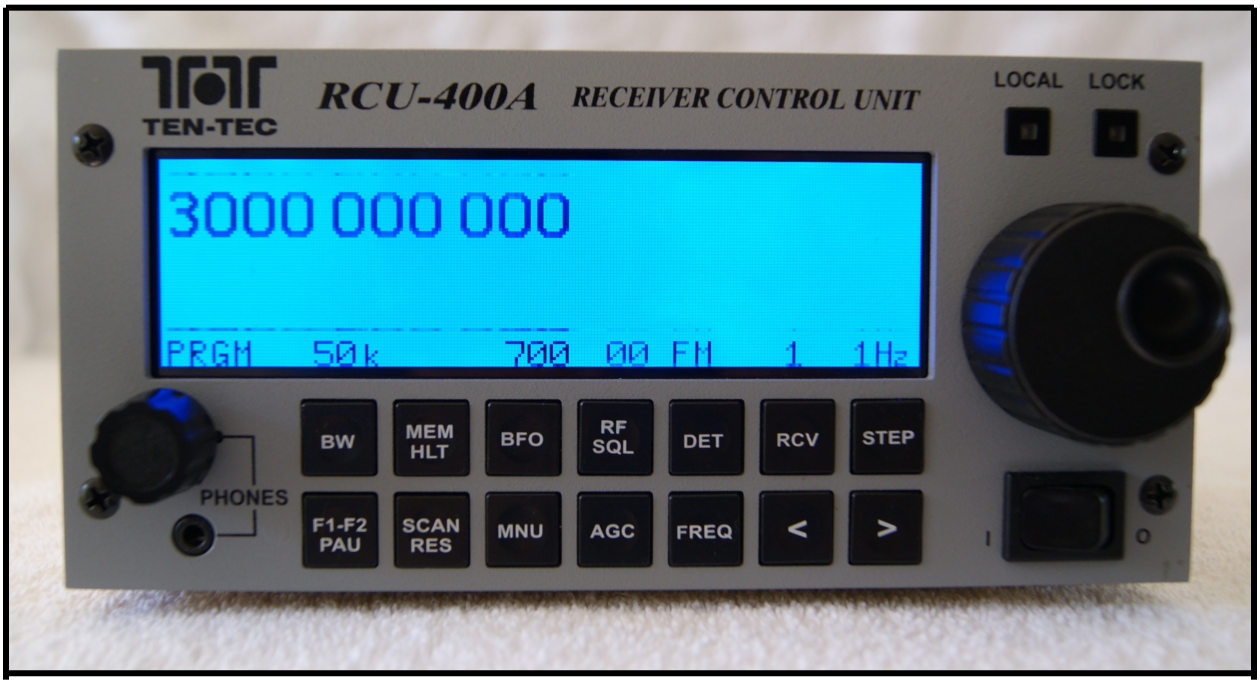

FIGURE 2-1 RCU-400A Front View

PN 74436

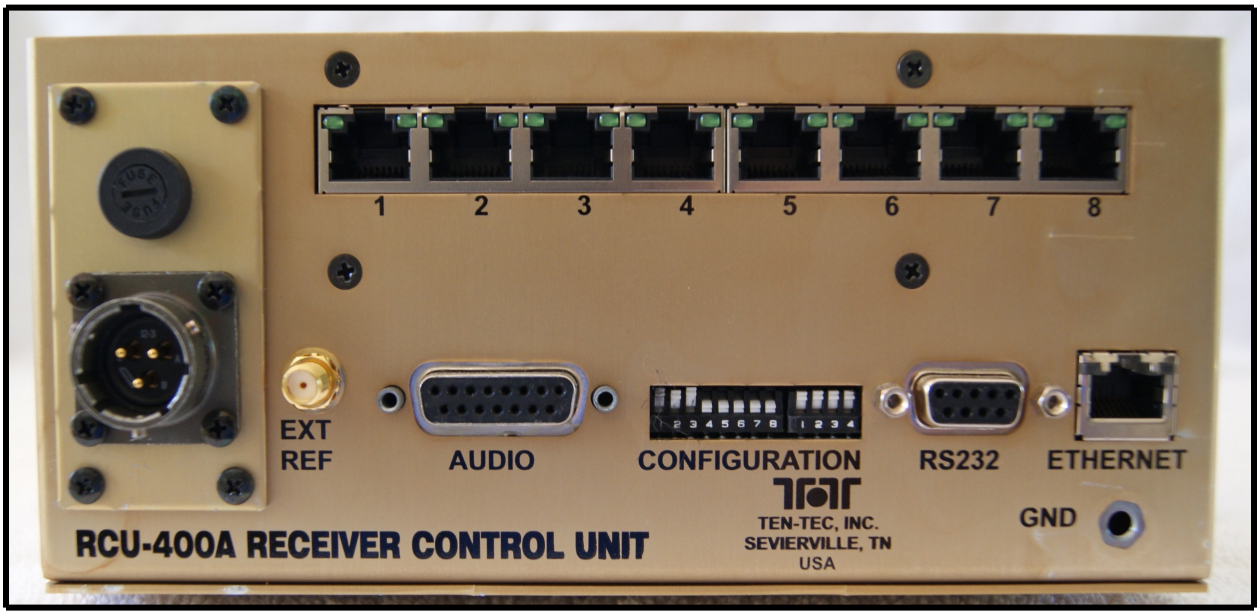

FIGURE 2-2 RCU-400A Rear View

All electrical interface to the RCU is via rear panel connectors for power, external reference, line audio outputs and remote control. Seven (7) of the eight (8) ports of the Ethernet switch are available for connection to RX-400A receivers. The RCU-400A contains two (2) command and control ports, an Ethernet IP RJ-45 connector and a standard RS-232 connector. Generally the RS-232 port is used as the firmware update port and the Ethernet port accommodates a connection to the system LAN for mission download capability.

The RCU-400A contains all the circuitry required to effect control of up to seven RX-400A receivers. The major assemblies consist of (1) a front panel with an LCD display, main tuning knob, audio volume control and headphones jack, (2) a Logic/DSP assembly, (3) an remote interface board, (4) an eight-port 'smart' Ethernet switch and (5) an AC power supply.

Internal RCU firmware establishes the operating features and parameters necessary to control and display all RX-400A receiver functions. This firmware can be updated in the field using a laptop computer or system host PC/workstation with the appropriate drivers. See Chapter 6 for details.

2.2 SPECIFICATIONS

TABLE 2-1

Parameter	Feature/Performance
Controls (encoders & switches):	
Frequency Tuning	Rotary encoder, weighted knob, with Adjustable drag setting
Tuning Lock	Pushbutton, dedicated key
Power	Push, Left/Right toggle, ON/OFF
Audio Gain	Dedicated rotary encoder
Remote/Local	Dedicated Pushbutton
Menu Keys	Two rows of 7, (14) pushbuttons
Receiver Parameters	Multi-pot encoder (tuning knob) for: RF Gain, Detection Mode, IF Bandwidth, Step Size, F1-F2, Squelch, BFO, AGC, Scan, Memory Channel Load/Recall, Up > Down < keys, Receiver #, and Menu key
Display Readouts:	
Display Panel	LCD, Blue Backlit, 30 second timeout
Readouts	Frequency (to 1Hz resolution), IF bandwidth (in kHz), Detection Mode, Step Size (highlight of frequency digit), Signal Strength (bar graph), F1 start, F2 stop, Gaze, Dwell, Dead-time, FS (during scan), AGC (On/Off, Fast, Med., Slow, Program) Memory Channel Load/Recall/Skip
Interface:	
Receiver Control	Ethernet connection between each receiver (up to 7) and a numbered port on rear panel Ethernet switch
External Host	Rear panel Ethernet LAN for Mission Down- Load facility from host PC/Workstation
Firmware Update	Via RS-232, connection to laptop/PC
Audio	Front panel phones jack(1/8”) and rear panel Line audio for selected receiver
Connectors:	
Ethernet	LAN and 8-port Switch, RJ-45
RS-232	Standard 9-pin D
External reference	SMA; 1,2,5 or 10 MHz, auto sense
Line Audio	15-pin D
AC Power	MS-type, circular, 3-pin, keyed

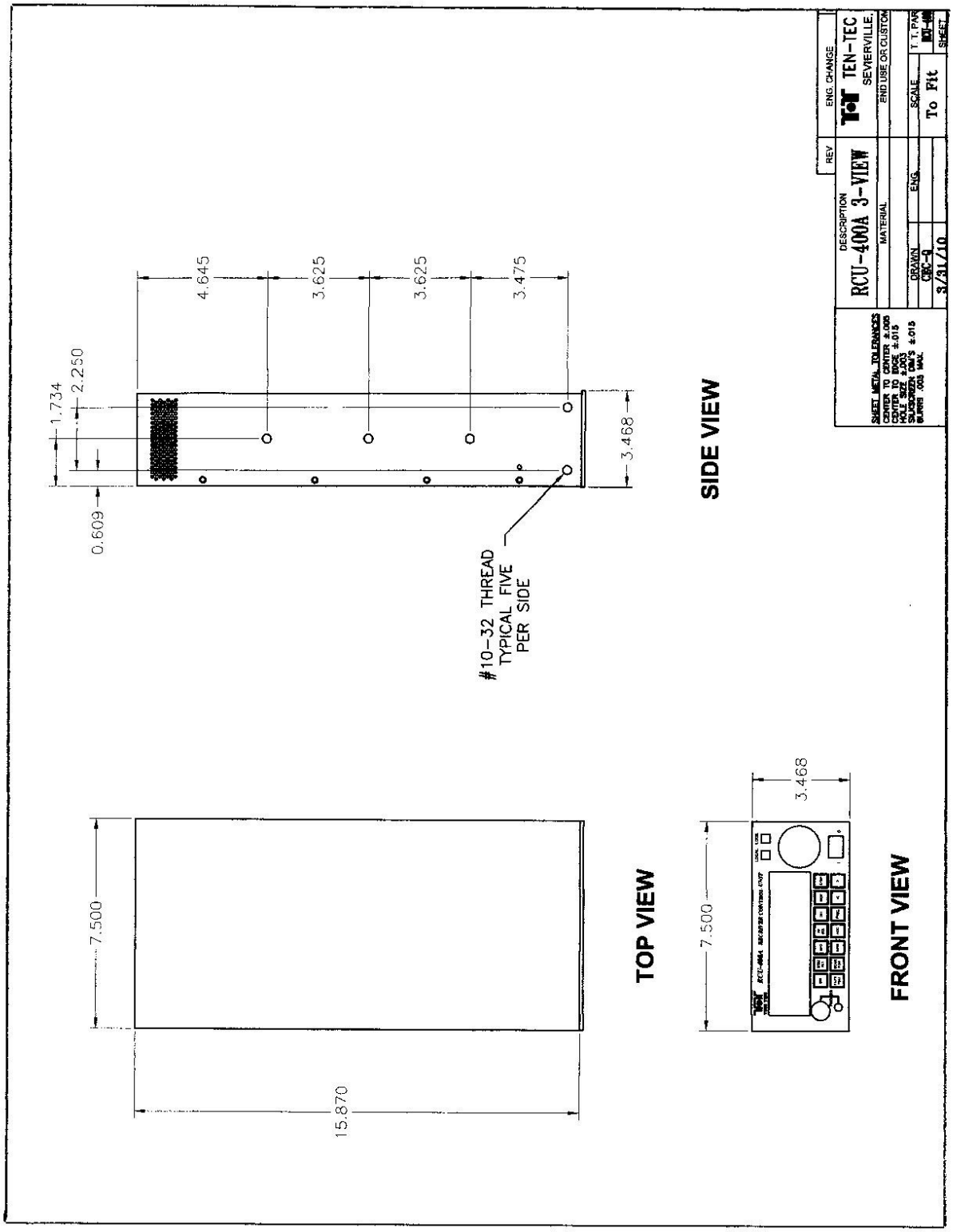

FIGURE 2-3 RCU-400A Three View Drawing

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2.2 ENVIRONMENTAL CONDITIONS

The RCU-400A Receiver Control Unit is a rugged design intended for commercial, government and military applications. The unit is specifically suitable for fixed site, vehicle or shelterized installations, shipboard service and cabin-class turbo-prop/jet aircraft if appropriate shock and vibration isolation is provided. The RCU-400A is a COTS product and as such is not certified to MIL-STD-810 standards, however the unit is designed to meet shock and vibration levels associated with procedure 514 for cabin-class aircraft environments.

With regard to RFI/EMI the RCU-400A is designed to meet, although not factory tested, to MIL-STD-461F for CE02, CE03, RS01, RS02 and RS03.

The RCU-400A is designed to operate under the conditions in Table 2-2.

TABLE 2-2
ENVIRONMENTAL CONDITIONS

Parameter	Specification
Operating Temperature	0 to 50 degrees C, full specification
Operating Limits	Functional, -10 to +60 degrees C
Storage Temperature	-40 to +70 degrees C
Humidity	10-95%, without condensation
Altitude	+15,000 feet MSL, un-pressurized

2.4 MECHANICAL

The RCU-400A is housed in a standard 2U high EIA half-rack chassis. It has a behind the panel depth of 16.00 inches (407mm), excluding connectors.

Construction is all aluminum with wrapped corners and a thick front panel to accommodate rack mounting. Top and bottom covers are affixed using flat head screws. 10-32 threaded inserts are installed in the chassis sides to accommodate user slides. The rear panel has a 10-32 threaded insert to accept a chassis ground connection. The chassis is chem.-treated to resist corrosion and the front panel is painted gray with black silk screening.

The RCU-400A weighs 7.60 lbs. (3.45 kG)

Figure 2-3 depicts a 3-view drawing for the RCU-400A Receiver Control Unit.

2.5 ELECTRICAL

Power requirements for the RCU400A are presented in Table 2-3.

TABLE 2-3
RCU-400A POWER REQUIREMENTS

Parameter	Specification
Line Voltage	90 to 264 VAC
Frequency	48-440 Hz, single phase
Power Consumption	15 Watts, nominal
Power Connector	Circular MS type connector, 3-pin, male
Spikes and Noise	Designed to meet MIL-STD-704, but not tested at factory
Power Connection	Pin-A, AC High; Pin-B, AC Low; Pin-C, AC Ground

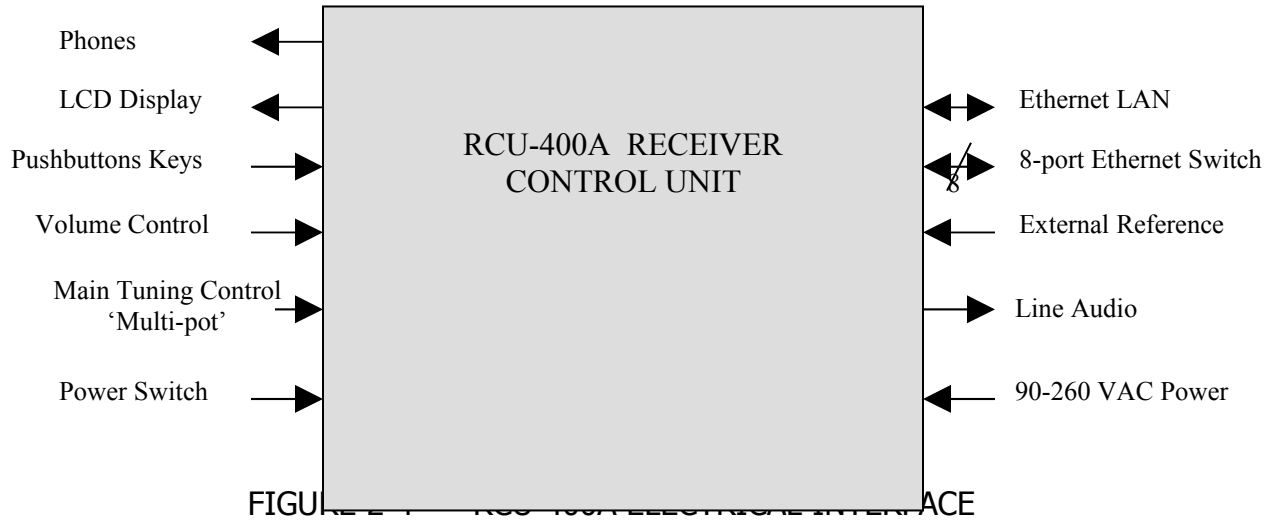

FIGURE 2-4 RCU-400A ELECTRICAL INTERFACE

3.0 PREPARATION FOR USE AND INSTALLATION

3.1 UNPACKING AND INSPECTION

Examine the shipping carton for damage before unpacking the unit. If the carton is damaged, attempt to open it in the presence of the shipping agent. If this is not possible then document or photograph the carton damage for a matter of record. If undamaged then retain the carton and packing material for future use.

Remove the packing material from the top of the unit and lift the RCU-400A Receiver Control Unit (RCU) free of the carton. Next remove the clear plastic bag from the unit. Inspect the unit for external damage with particular attention to dents or bent sheet metal. Also inspect front panel components and rear panel connectors for damage. If external damage is evident then remove top and bottom covers of the RCU by removing multiple screws along the cover edges, then inspect all the internal assemblies for damage such as cracked circuit cards or broken or loose components. DO NOT ATTEMPT TO OPERATE THE EQUIPMENT IF INTERNAL DAMAGE IS NOTED. Upon finding any damage contact the shipping agent and contact the TEN-TEC factory to arrange for unit repair.

3.2 MOUNTING

The RCU-400A may be mounted as a single unit or side-by-side with another 2U half-rack piece of equipment in a standard EIA 19" rack enclosure. For single unit rack installation please contact TEN-TEC to secure the correct rack mount kit. For most common mounting arrangements the RCU-400A will be installed side-by-side with a RX-400A Receiver to fill a 2U rack opening. Side-by-side mounting is accomplished by using the RM-400-2 Rack Mount Kit. The RCU-400A has 3 threaded inserts on each side of the chassis to accept 10-32 x 0.50" long screws for use with customer furnished chassis slides. The hole pattern is compatible with Jonathan model 375QD or equivalent.

The rack mount kit contains 4 pieces as listed in Table 3-1.

TABLE 3-1
RM-400-2 Rack Mount Kit Contents

Item	Description	Quantity
001	U-Channel Bracket	1
002	Front Panel Center Bracket	1
003	Rack Mount Ears (R & L)	2
004	10-32, Hex Head Attachment Screws	12

To use the RM-400-2 rack mount kit, first attach the U-channel bracket to the 'inside' side of one of the chassis using the rear 2 mounting holes out of the set of 3, with the furnished screws. Then attach the front panel bracket to the chassis with the flat side toward the front panel surface. Next, position the second chassis so the U-channel and front panel brackets can be attached to the second chassis. Now the 2 units are secured together with about a 2 inch gap between the chassis. Next attach the left

hand and right hand brackets (rack mount ears) using the furnished screws. The ears are attached using 2 threaded 10-32 inserts at the front of the RCU-400A and RX-400A chassis. Refer to Figures 3-1 and 3-2 for parts orientation.

3.3 POWER

Ensure the Power Switch is in the OFF position on The RCU-400A (left side of switch depressed toward front panel, '1').

3.4 REAR PANEL CONNECTIONS

3.4.1 Power Cable

Connect a customer furnished power cable with a female MS-type 3-pin plug to the power connector on the rear of the RCU-400A. Pin wiring for the cable must be identical to that listed in Table 2-3. Next plug the other end of the cable into a 90-260 VAC, single-phase power source.

3.4.2 External Reference

If an External Reference used, it is connected to the RCU via a rear panel SMA connector.

3.4.3 Audio Connections

Balanced Line Audio is available on a rear panel 15-pin D connector where connections are made via a customer furnished mating connector and cable assembly. Pin assignments are listed in Table 3-2.

3.4.4 Remote Control Connection

RCU interface is via two (2) connectors on the rear panel. One is a RS-232 interface using the standard 9-pin D type connector. The other is ETHERNET using a RJ-45 type jack. The RS-232 port is used for firmware updates and the Ethernet jack is for connection to a LAN to facilitate mission downloads from a host PC or workstation. Please see Chapter 7 for detailed information for data interface formats.

FIGURE 3-1 RX-400A & RCU-400A RACK ASSEMBLY

3.4.5 Connections To RX-400A Receivers

For operator manual control of receivers, the RCU is connected to each receiver using a dedicated Ethernet cable between a numbered RJ-45 jack on the RCU rear panel and companion RX-400A Receiver(s), where both equipments are either co-located or at a different position, provided standard Ethernet cable run length conventions are not exceeded. This connection provides the control and status data link as well as providing the path for receiver digital audio streaming to the RCU. When connected in this arrangement The RX-400A's and the RCU-400A should be connected to the Ethernet switch, with receivers connected to ports 1 through 7 and the RCU connected to port 8 with a short cable to the Ethernet interface jack.

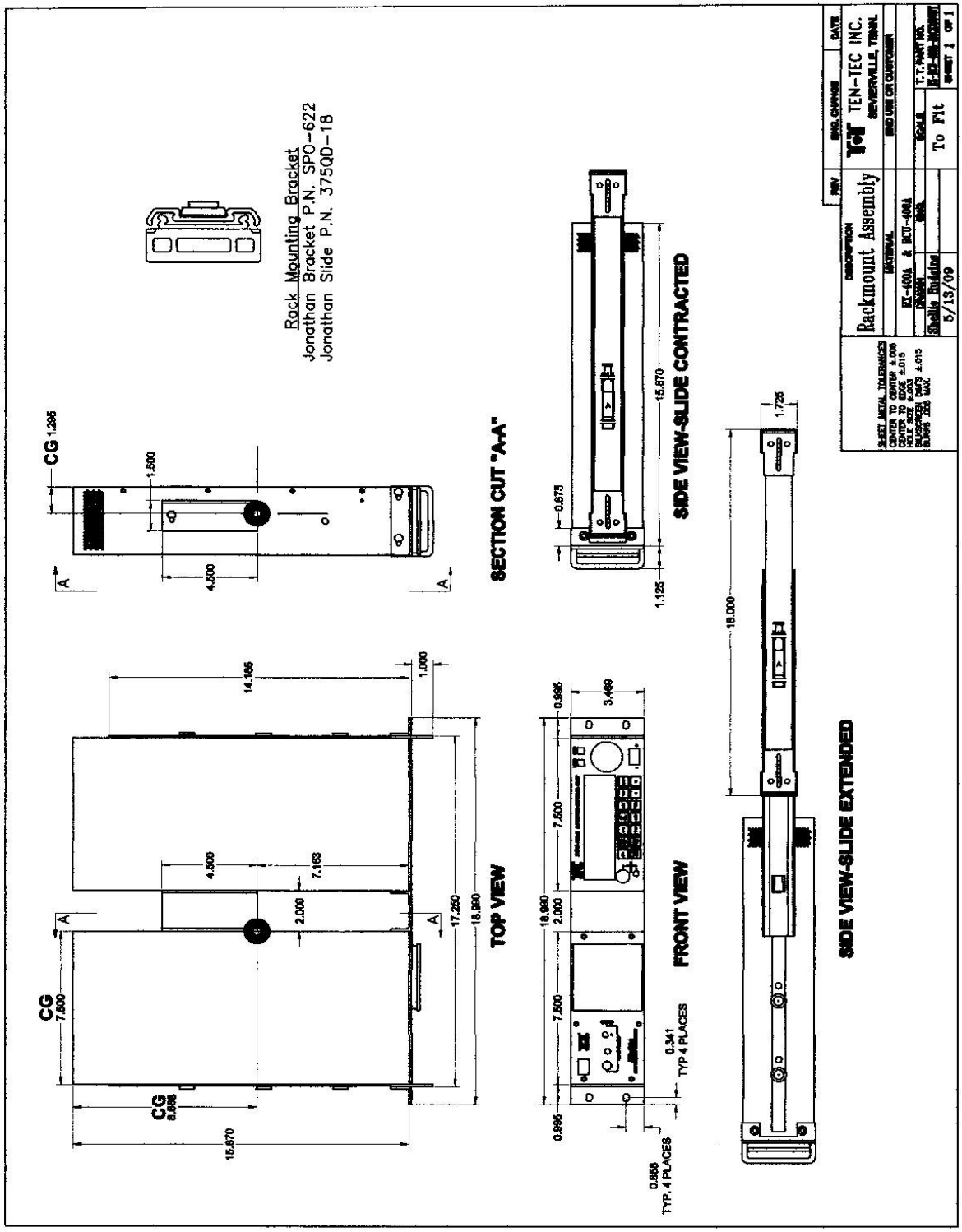

FIGURE 3-2 RX-400A and RCU-400A INSTALLATION

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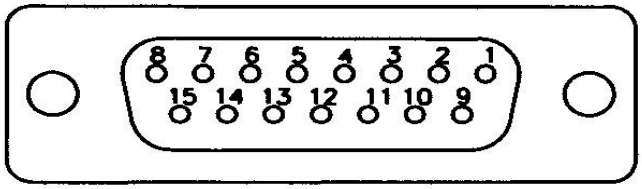


Figure 5 - Audio Connections

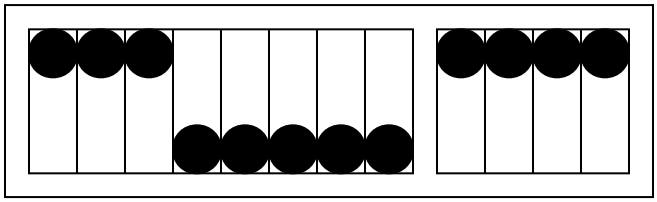
Pin	Description	Note
1	Chassis Ground	
2	A/C Coupled Mono Audio	Unbalanced +10dBm output.
3	Line B-	600 Ohm balanced output. 0 dBm nominal
4	Line B center tap	
5	Line B+	
6	Line A-	600 Ohm balanced output. 0 dBm nominal
7	Line A center tap	
8	Line A+	
9	Chassis Ground	
10	DC Coupled Mono Audio	Unbalanced +10dBm output.
11	No Connection	
12	User Programmable Output #1 (not available when frequency extender attached)	Low = 0 volts, High = 3.3v
13	User Programmable Output #2 (not available when frequency extender attached)	Low = 0 volts, High = 3.3v
14	User Programmable Output #3 (not available when frequency extender attached)	Low = 0 volts, High = 3.3v
15	User Programmable Output #4 (not available when frequency extender attached)	Low = 0 volts, High = 3.3v

TABLE 3-2
RX-400A AUDIO CONNECTIONS

If connection to another network is required it should be made to the Ethernet switch. This Ethernet switch is an active switch that will manage the data flow between the two units while isolating traffic between the RCU and RX-400A receivers from the outside network, resulting in reduced global network traffic.

3.5 CONFIGURATION DIP SWITCH

The rear panel contains a recessed two section Dip Switch used to set the operating configuration for the Receiver. The first section contains 8 switches and the second contains 4 switches. For normal RCU-400A operation, place the first section with switches 1, 2 and 3 in the UP position and 4 through 8 in the DOWN position. All four switches (1 through 4) are placed in the UP position for the second switch section.



3.6 FUSE

A replaceable fuse is located above the power connector on the rear panel. The fuse is removed and replaced using a small (1/8") wide common blade screwdriver. Replace it with a 5x20 mm, 1 Amp, 250VAC, time delay fuse.

3.7 FRONT PANEL CONTROLS AND DISPLAYS

The RCU-400A is designed to provide all the controls and displays necessary for comprehensive control of connected RX-400A HF/VHF/UHF Receivers. Chapter 4 provides a detailed description of control functions and steps required for receiver operation.

3.7.1 Power Switch

The front panel power switch is a left/right toggle type where to the left is ON (1) and to the right is OFF (0). Generally the power sequence should be all RX-400A turned ON first followed by the RCU-400A.

3.7.2 Tuning Knob

The large main tuning knob is a shaft encoder which is used as the main frequency tuning control but also functions as a 'multi-pot', where it is used as a rotary control for most of the receiver control functions, dependent on which function key has just been pressed, such as RF Gain, Squelch, BFO etc..

3.7.3 Pushbuttons

14 pushbuttons are used for selecting various receiver control functions.

3.7.4 LCD Display

A large LCD is used to provide the operator with a screen presentation of the receiver functional status with all the alpha-numeric information required to operate a selected receiver. It has blue back-lighting with a 30 second time out without control movement for night-time or dark operating environments.

3.7.5 Volume Control

A front panel audio gain control is provided for the front phones jack.

3.8 HEADPHONES JACK

A 1/8" stereo headphones jack is provided on the front panel. This audio is reconstructed audio, that is, receiver audio that has digitized, streamed to the RCU, then converted back to an analog format for operator listening.

3.9 CHASSIS GROUND

A chassis ground connection should be made on the rear panel using a 10-32 x ½ inch screw and terminal lug. The ground wire should be AWG #16 or larger.

3.10 TYPICAL INTERCONNECTIONS ----RCU-400A To RX-400A

Figure 3-3 depicts the typical interconnections required between the RCU-400A Receiver Control Unit and RX-400A HF/VHF/UHF Receiver(s).

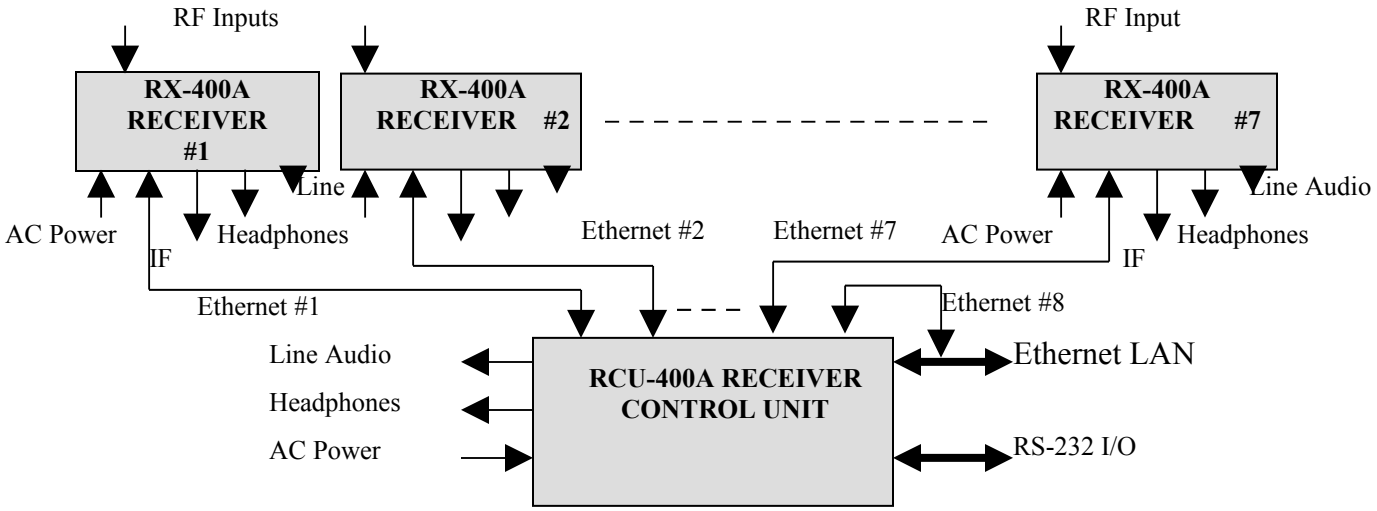


FIGURE 3-3 RCU/RX Interconnections

4.0 OPERATION

The RCU-400A Receiver Control Unit provides manual control of up to seven (7) companion RX-400A HF/VHF/UHF Receivers. This chapter gives step-by-step instructions for operating all the functions of the RX-400A Receiver.

4.1 POWER ON/OFF

In an installation having a RCU connected to between 1 and 7 receivers, each receiver's power is turned 'ON' first by depressing the right side of the toggle switch toward the front panel, followed by the RCU power up by depressing the left side of its power switch to the '1' position. This sequence is preferred to ensure the comms link to each receiver is properly established. Upon power down turn the RCU 'OFF' followed by the receiver(s).

4.2 HEADPHONES VOLUME

The headset audio level may be adjusted by rotating the VOLUME control, minimum at full CCW position, full volume at full CW position.

4.3 CONFIGURATION SWITCH SETTINGS

Verify that the rear panel Configuration Switch Settings are as described in paragraph 3.5 of this manual.

4.4 DETAILED OPERATING INSTRUCTIONS

For most operations a standard 'control convention' sequence is employed relative to the pushbutton and rotary control actions as depicted below.

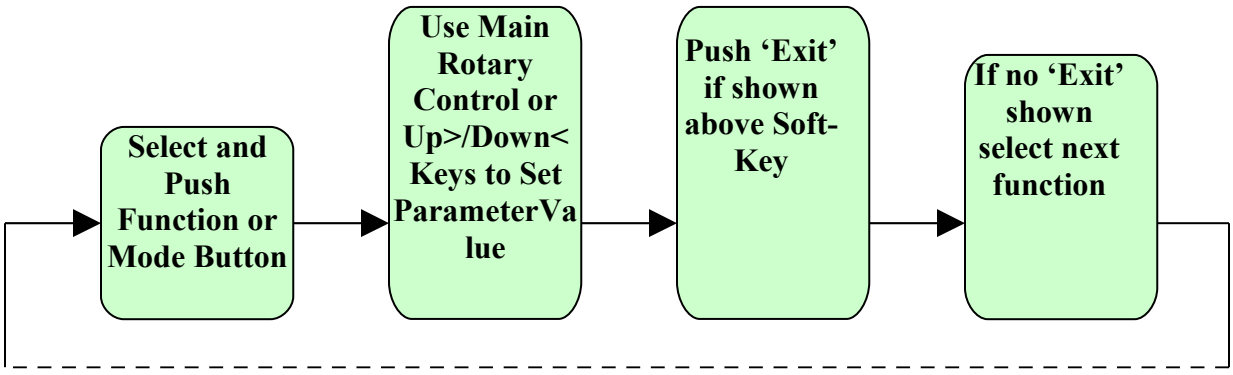

Select and Push Function or Mode Button
Use Main Rotary Control or Up>/Down< Keys to Set ParameterValue
Push 'Exit' if shown above Soft-Key
If no 'Exit' shown select next function

FIGURE 4-1 Control Convention

4.4.1 Front Panel Overview

The front panel contains a large LCD display which presents a selected receiver operating parameters, a large main rotary control, an audio gain control for the headphones, ON/OFF power switch, a LOCAL indicator, LOCK indicator, and two rows of pushbuttons (7 in each row). The bottom row of pushbuttons are dedicated to specific functions and the top row of pushbutton are either directly associated with the function call-out on the button, or act as soft keys when functions in the display above each key are for additional operations not labeled on the pushbutton.

FIGURE 4-2 FRONT PANEL OVERVIEW

The depicted display shows the top row acting as specific function keys. The Soft-Key mode for the top row is generally used for Frequency Scan and Memory Scan Modes and will be described in later paragraphs.

4.4.1.1 Control Functions

With reference to FIGURE 4-2, Front Panel Overview, the following descriptions in TABLE 4-1 below apply for each control function.

Control Label	Control Function
'1' ----- '0'	Power ON/OFF switch
None, Main Knob	Multi-pot for frequency and parameter settings
Phones	1/8" stereo headphones jack and audio gain control
LOCAL	Indicator, illuminates when in local mode
LOCK	Indicator, illuminates when RCU controls are locked
BW	Selects receiver IF bandwidth, pushing BW scrolls through available bandwidths, or use <, > keys, 27 filters from 100 Hz to 300 kHz
MEM/HLT	Selects Memory Channel Scan Mode or halts scan
BFO	Enters value of BFO offset via Multi-pot or <, > keys, displayed in Hz, from 000 to 8000
RF/SQL	Toggles between RF gain and Squelch setting, use Multi-pot or <, > keys to set value, range for both parameters is 000 to 120
DET	Select receiver detection mode, pushing button scrolls available modes or use <, > keys, for: AM, FM, USB, LSB, CWU and CWL
RCV	By using <, > keys, selects Receiver number to be controlled by RCU, 001 through 007
STEP	Selects frequency step size when tuning receiver, use <, > keys to set value, from 1 Hz to 1GHz
F1-F2/PAU	Selects F1-F2 frequency scan mode display to enable entry of scan parameters, alternately pauses scan

TABLE 4-1 CONTROL FUNCTIONS

Table 4-1, continued

Control Label	Control Function
SCAN/RES	Selects the Scan Mode screen from which F1-F2 and Memory Scan modes can be launched, alternately resumes scan after a halt
MNU	Depressing this key displays receiver IP and MAC Addresses in sequence using the <, > keys, also selects BIT test for selected receiver
AGC	Scrolls through FAST, MEDIUM, SLOW and PRGM AGC modes
FREQ	Depressing FREQ and using <, > keys (in this case left and right) selects and high-lights the frequency digit to be changed with the Main Tuning Knob
<	Down or Left Key
>	Up or Right Key

4.4.2 Initial Configuration Upon Power Up

Initial configuration of the RCU-400A requires setting the IP address of the RCU and RX-400A receivers connected to the RCU. Also if the RCU will be connected to a receiver located off site, the IP address of the gateway will also need to be programmed into the RCU-400A.

Under normal operation the IP address can be viewed on the RCU but cannot be altered. To enable editing of the IP address, hold down the MNU button while turning on the power to the RCU. When the main display screen appears, press the MNU button again to enter the IP address set-up screen. When the IP address screen is displayed, pressing the button located below any octet of the address will allow the number to be changed using the Main Tuning knob. To move between IP addresses use the < and > arrow keys. When editing of the IP address is complete, press the MNU button to return to the main display screen. Then turn the RCU OFF, then back ON. The RCU-400A is now configured to use the new IP addresses. See Figure 4-3.

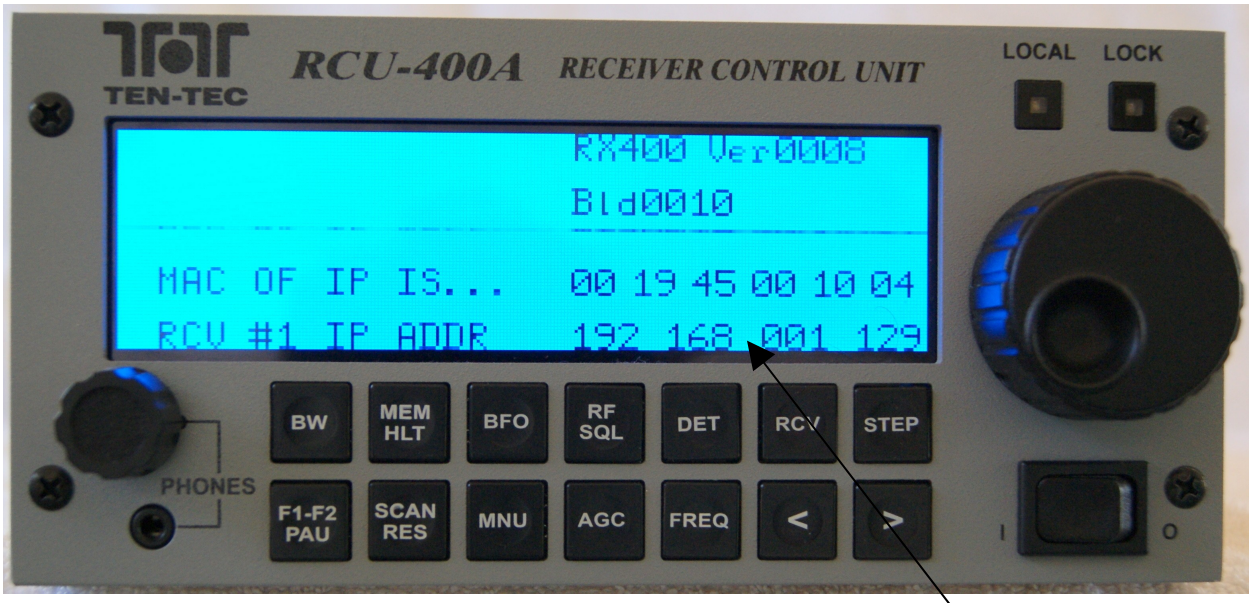


FIGURE 4-3 IP ADDRESS

Upon application of power to the receiver(s) and the RX-400A Receiver Control Unit, the RCU LCD display will indicate the RCU software version and applicable date, followed by a readout of 'SEARCHING FOR RECEIVER. See Figure 4-4

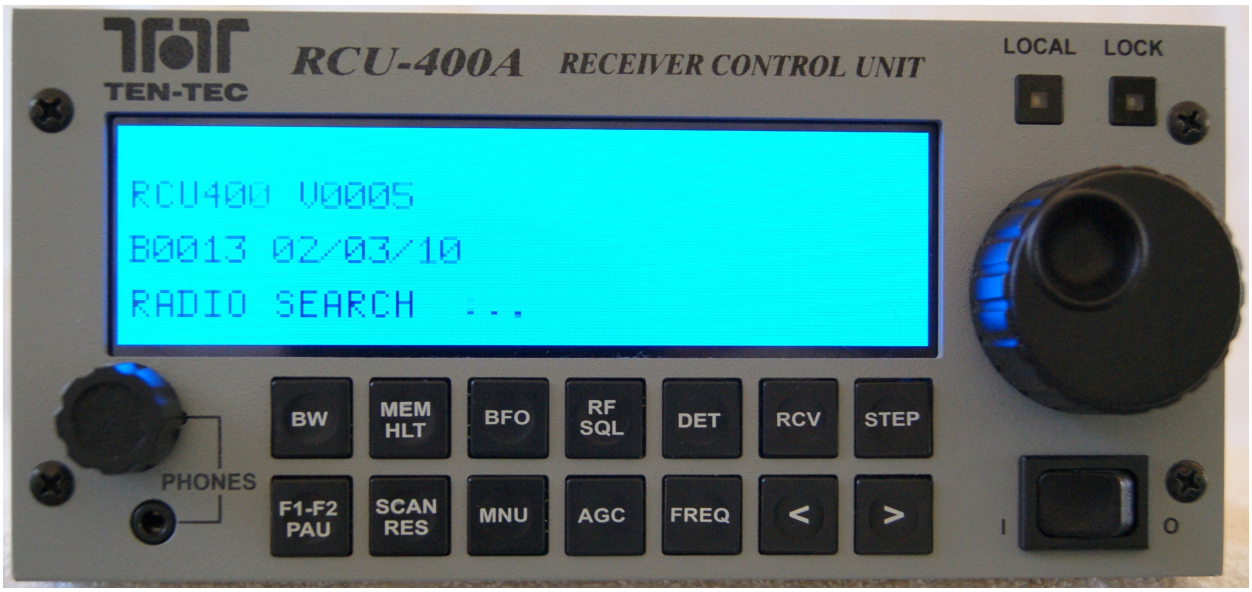


FIGURE 4-4 Power-Up Display

Upon finding the RX-400A Receiver, the LCD display will depict the initial factory default settings.

4.4.3 Factory Set Defaults

After the RCU finds the connected receiver it will set the receiver to factory defaults for frequency, detection mode, BW, AGC mode, RF Gain, Squelch, receiver number and tuning step size as shown in FIGURE 4-5.

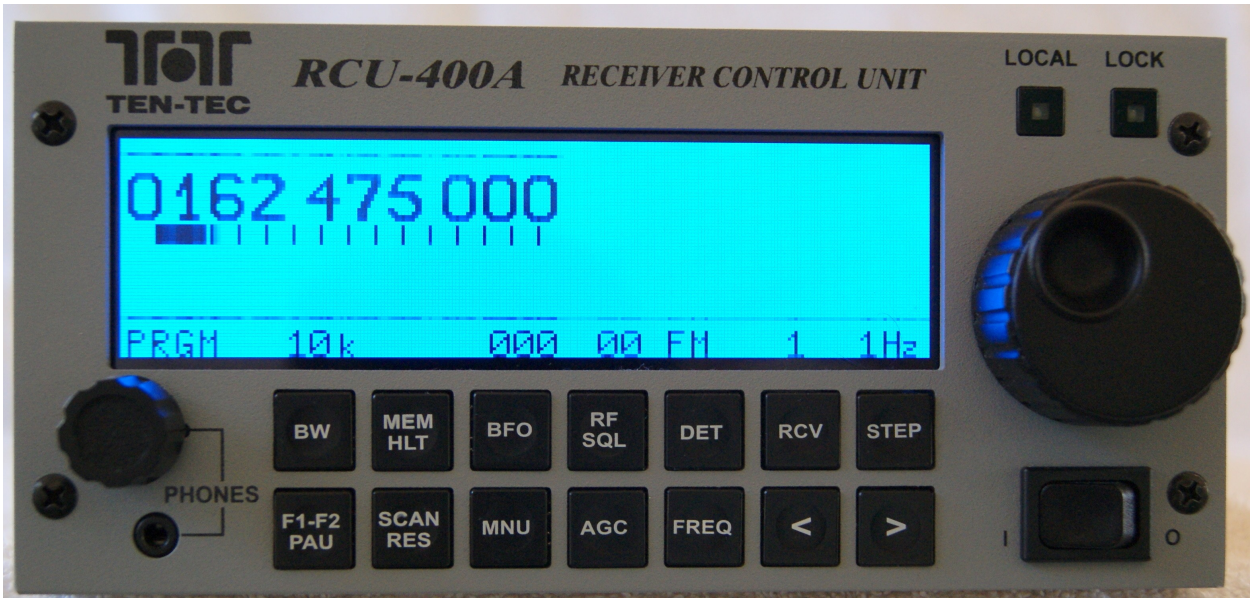


FIGURE 4-5 Power Up Factory Default Settings

4.4.4 Operation

The RCU-400A is designed to provide the operator the facility to search for signals of interest, perform signal monitoring and signal collection tasks. This is accomplished using three different signal acquisition modes, (1) Manual Tuning, (2) F1 Start-F2 Stop Frequency Step Tune Scans and (3) Directed Search by scanning previously loaded memory channels (Memory Channel Scan Mode). These modes of operation, coupled with scan frequency lock-outs and memory channel skip functions provides a very versatile COMINT intercept tool.

A 'Multi-pot' main control knob is used for manual frequency tuning and other receiver parameters such as BFO offset, RF Gain and Squelch, in conjunction with dedicated and soft-key pushbutton switches.

This sub-chapter provides step-by-step instructions for the RCU-400A Receiver Control Unit. The instructions are supported by panel display depictions with appropriate call-outs and primary operating mode flow diagrams.

4.4.4.1 Manual Tuning

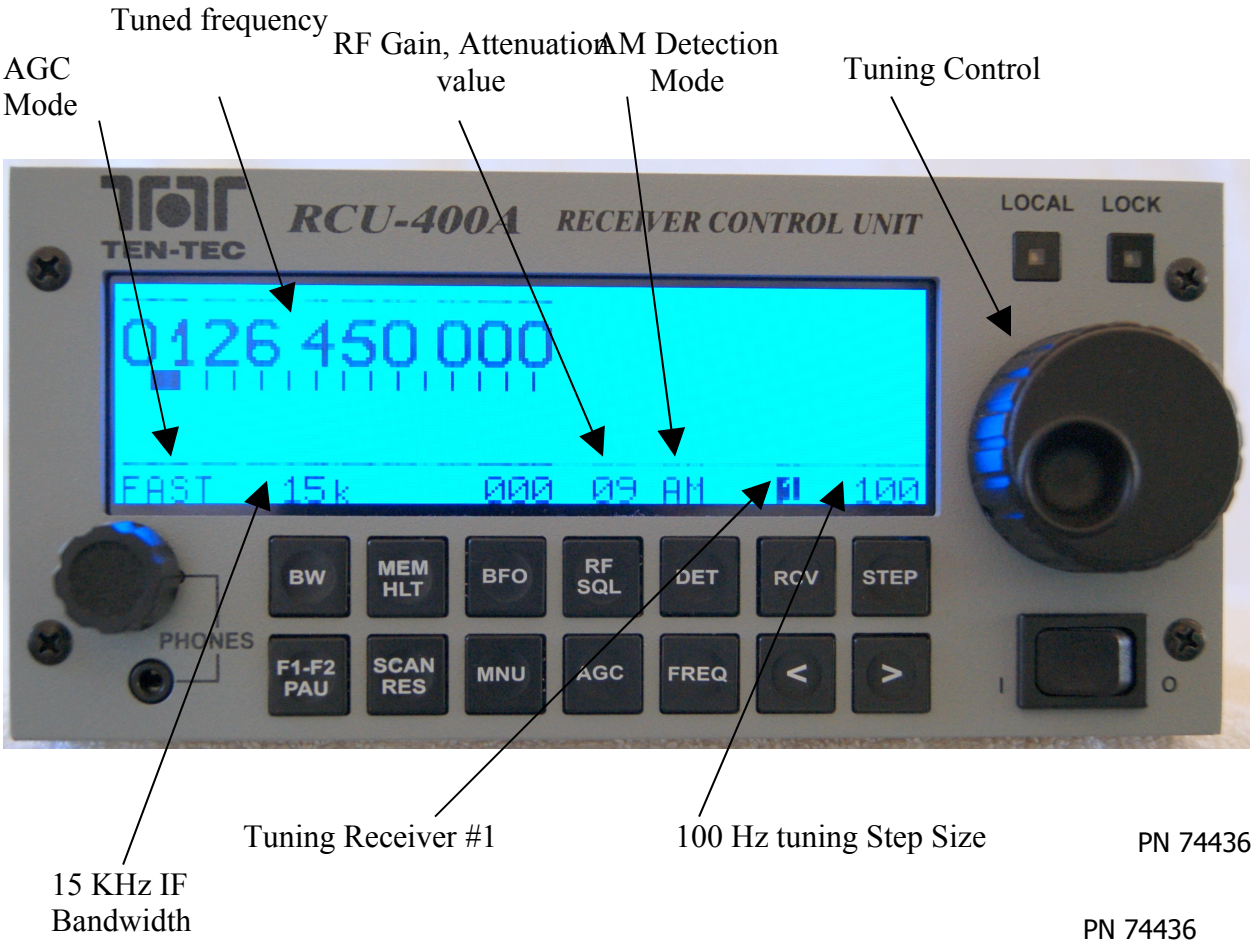
Manual tuning consists of using the main rotary control knob to tune through frequencies of interest. To perform Manual Tuning, see Figures 4-6 and 4-7.

4.4.4.1.1 Step Size

Prior to tuning, the desired tuning step size is selected by depressing the STEP pushbutton. This high-lights the step size on the display. To change the current value, scroll through the values using the < > arrow keys. The value of step sizes range from 1 Hz to 1GHz.

4.4.4.1.2 Using the FREQ Button

Another method of tuning involves the FREQ key. Depressing this button high-lights one of the frequency digits on the display. Use the < > arrow keys to move left and right to select digit that will be changed using the main tuning knob. This method is useful when making a move from one frequency band edge to another, or when the operator wants to step through 'channelized' frequency allocations.



PN 74436

FIGURE 4-6 Manual Tuning

FIGURE 4-7 Manual Tuning Flow Chart

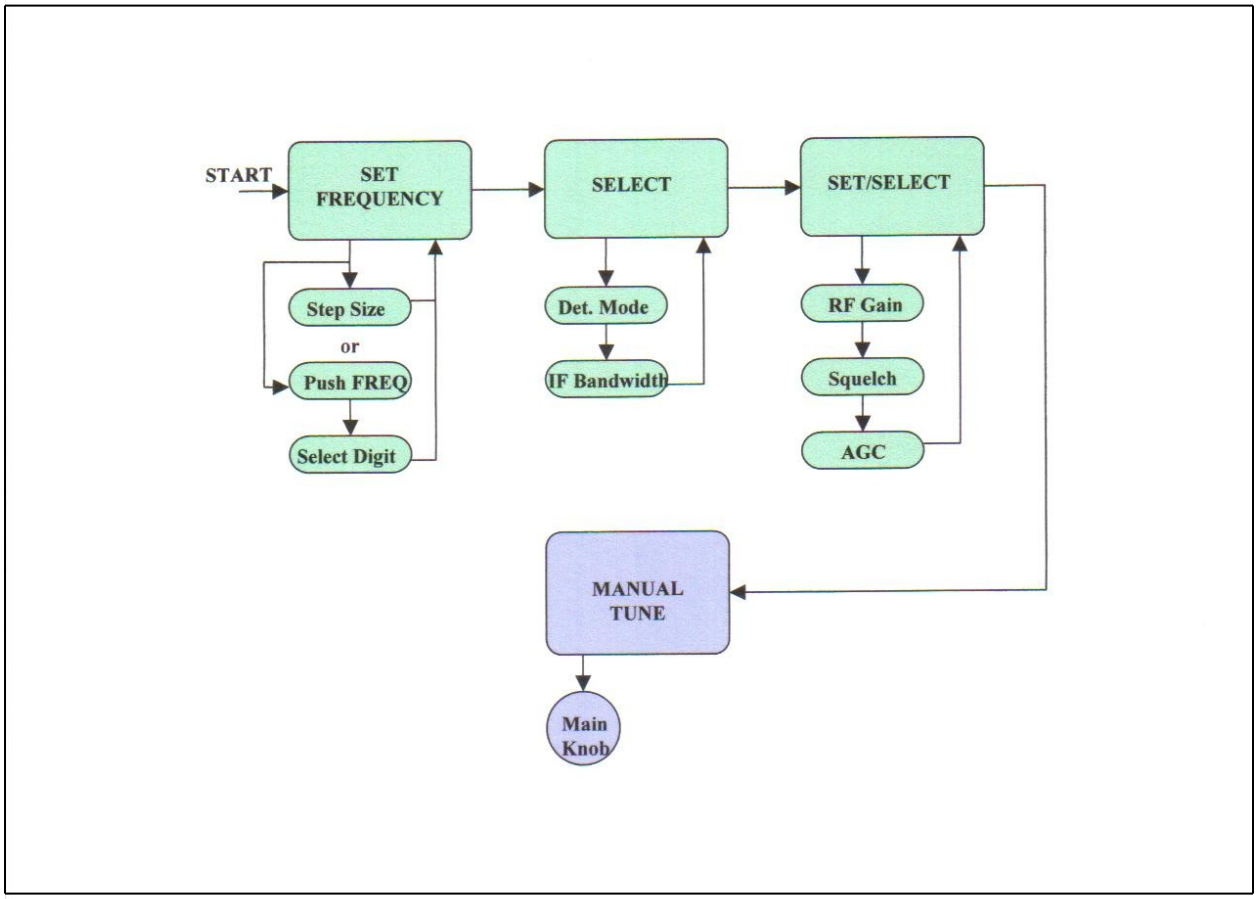


FIGURE 4-7 Manual Tuning Flow Chart

4.4.4.2 Using the Arrow < > Keys

The arrow keys function as Up/Down or Left/Right controls for several receiver operating parameters, where < is Down/Left and > is Up/Right. The arrow keys are associated with the top row of pushbuttons, that is, when one of these parameters is selected and high-lighted on the display, the arrow keys are used to set the value or select the mode for that parameter. The exception is when the FREQ button is depressed, which is discussed in paragraph 4.4.4.1.2.

Table 4-2 lists the parameters controlled by the Arrow Keys.

Parameter/Button	Action
STEP	Scroll through step sizes, 1Hz to 1 GHz
DET	Scroll through AM, FM, USB, LSB, CWU and CWL detection modes
RF	Sets RF Gain (attenuation) in 10 dB steps from 00 to 120
SQL	Sets Squelch level in steps of 10, from 00 to 120
BFO	Sets BFO offset in 100 Hz steps from 000 to 8000 Hz
BW	Scrolls through available IF bandwidth Filter selection, 100Hz to 300 kHz

TABLE 4-2 Arrow Key Functions

4.4.4.3 Detection Mode

Pushing this button high-lights the currently selected detection mode on the display. Repeated pushes provide a scroll through all the available detection modes.

4.4.4.4 Bandwidth

Pushing this button high-lights the currently selected IF bandwidth on the display. Repeated pushes provide a scroll through all the available bandwidths. Select the bandwidth that produces the cleanest audio response with minimal sideband noise.

4.4.4.5 RF Gain and Squelch Settings

The RF/SQL button toggles between two functions, RF Gain (attenuation) and Squelch Level (threshold). The value of the selected function is adjusted up or down in 1 dB steps using the main rotary tuning knob.

The RF Gain is adjusted for band conditions and sets the receiver sensitivity level, where 00=maximum receiver gain (sensitivity) and 120=maximum attenuation of the input signal. Generally, values between 00 and 30 will provide satisfactory performance. For weak signal work(signals close to the noise floor) run the RF Gain at 00. When operating in a strong signal environment it is sometimes useful to 'crank-in' some attenuation to prevent receiver front-end overload and possible distortion products.

Generally, when the receiver is used to manually tune through a band with known signal activity, the Squelch is set to a level just above the noise floor, 2 or 3dB, so that the background noise floor is not heard in the audio, just the signal of interest. When searching for weak signals close to the noise floor run the squelch at 00, that is, wide open, at the noise floor. The Squelch setting is also used as a threshold when in the SCAN modes, to determine the signal level that will trigger the scan routine to stop on a signal of interest. The required squelch setting is somewhat determined by particular band conditions and signal levels, relative to the noise level.

4.4.4.6

AGC Settings

Repeated pushes of the AGC button scrolls the AGC setting from Slow, Medium, Fast and Program modes. With no signal present the AGC will run the receiver gain at a high level for maximum sensitivity. Upon receiving a signal the AGC automatically sets the receiver gain based on the strength of the signal.

The AGC mode is selected based on band conditions and the type of signals being received in that band. Typically it is desirable to set the AGC in the SLOW mode for signals with steady carriers such as AM and FM. The MED mode is useful for SSB signals and for band conditions with considerable signal fading. The FAST mode works well with fast rise and fall time signals, such as CW (code), data formats and push-to-talk voice and burst data transmissions. Slow, Medium and Fast AGC modes have factory selected attack, decay and hang times. The PRGM mode permits the user to enter a custom set of AGC time constants to match particular signal formats. This accomplished via a command word downloaded from a host PC or workstation to the receiver flash memory. Chapter 7 of this manual contains the command word structure.

4.4.4.7 BFO Operation

The Beat Frequency Oscillator (BFO) is adjusted by pushing the BFO button which highlights this function on the display. The offset value is adjusted up and down in 1 Hz steps by rotating the main tuning knob. The total range is 000 to 8000 Hz. While the BFO is generally used for CWU and CWL detection modes, the BFO is active in all detection modes.

4.4.4.8 The Menu Key

Depressing the MNU (Menu) button brings up a display screen that shows the software version, MAC address and IP Address for Receiver number 1. Using the UP arrow key sequences through the MAC and IP addresses of receivers 2 through 7, followed by the Gateway IP address, then the software version, MAC and IP addresses for the Receiver Control Unit. The last button push in the sequence brings up a BIT test screen that provides the operator the choice of running a BIT test of the RX (receiver), RCU (receiver control unit) and MEM (memory). PASS or FAIL is indicated for the RX and RCU. The MEM display will read DISABLED. Figures 4-8 through 4-11 depict MNU screens.

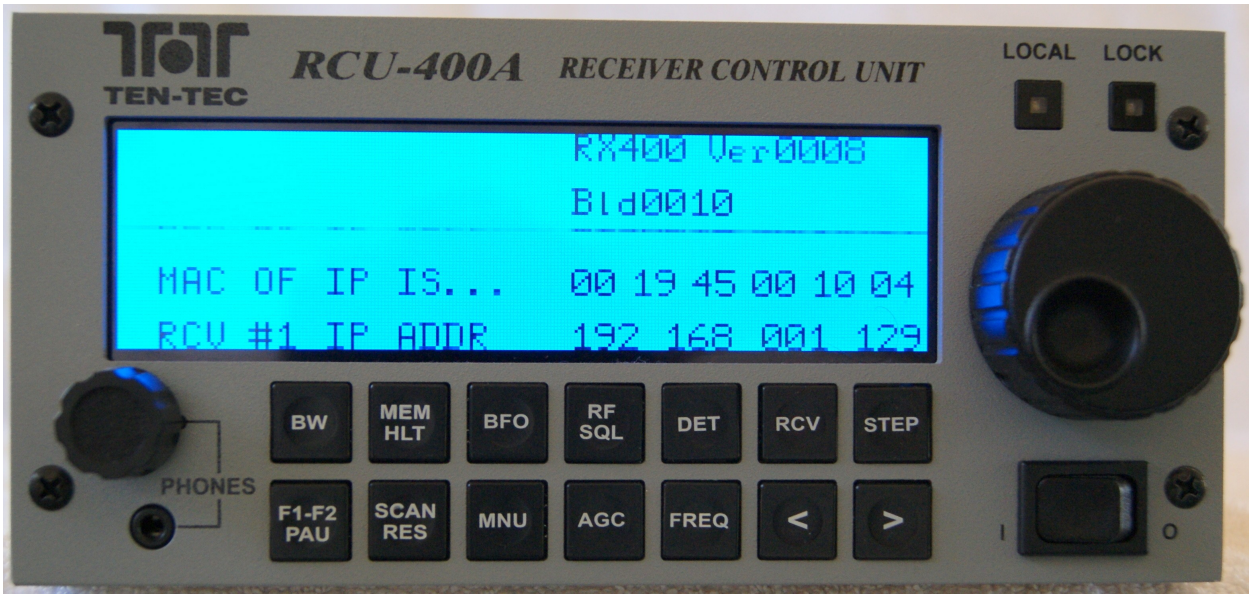


FIGURE 4-8 RX Address

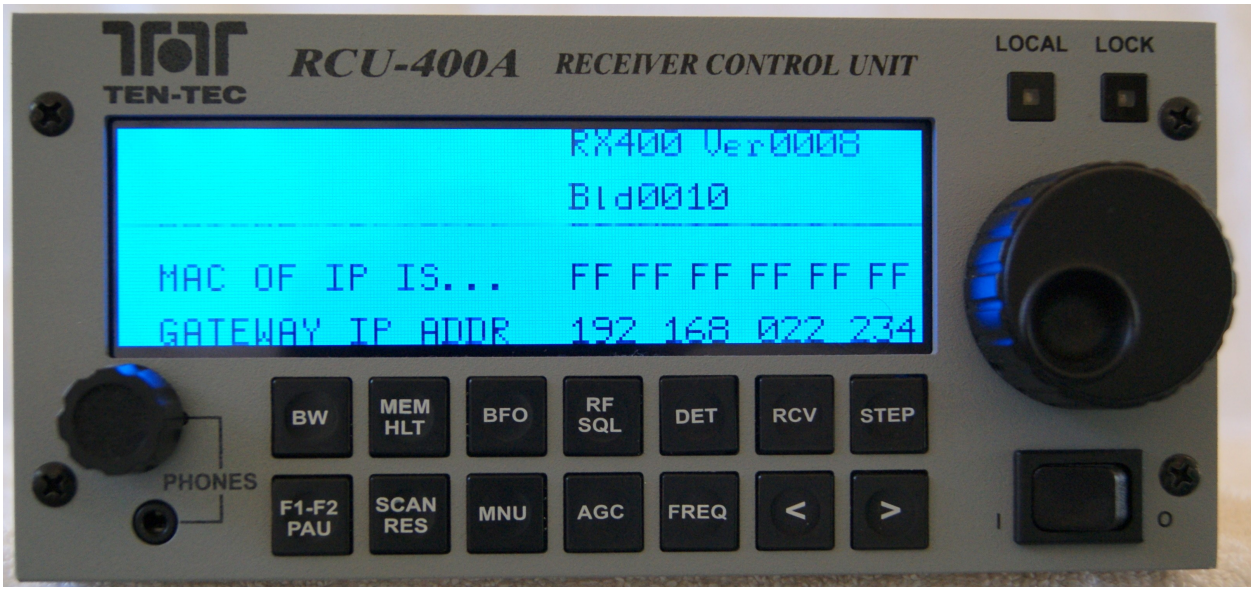


FIGURE 4-9 Gateway Address

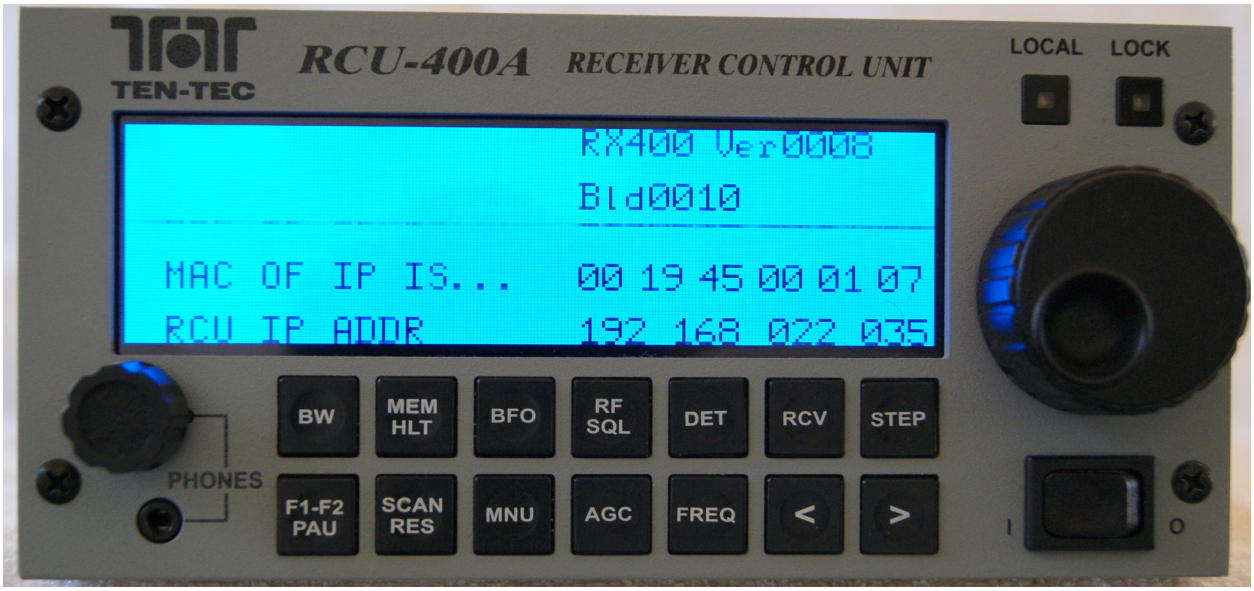


FIGURE 4-10 RCU Address

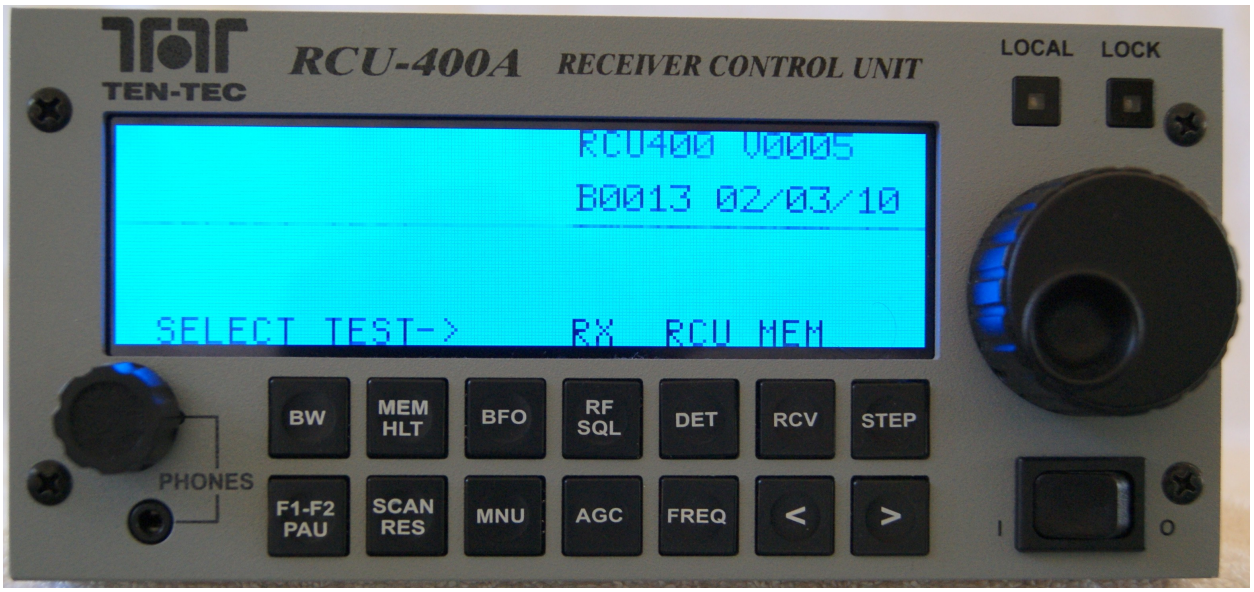


FIGURE 4-11 BIT Screen

4.4.4.9 Setting Up F1-F2 Frequency Scan Mode

Setting up the RCU for the F1-F2 Frequency Scan Mode requires several steps in the correct sequence. Table 4-3 lists and describes these steps. Also refer to Figures 4-12 and 4-13 which show the Scan set-up display screens.

Step Number	Action
1	Depress F1-F2/PAU button. This brings up a Scan screen
2	Depress the key below F1 (this is the start frequency)
3	Now, using the FREQ/Arrow Keys, and/or the main tuning set in the F1 frequency. Press F1 again. This sets value.
4	Now repeat for F2 (stop frequency)
5	Depress the key below FS (frequency tune step size)
6	Set in the value, as done for F1 and F2 steps
7	Verify all entries for F1, F2 and FS are correct, push EXIT

TABLE 4-3 Scan Mode Set-Up

Table 4-3, Continued

Step Number	Action
8	Depress the SCAN/RES button. This brings up the second Scan screen
9	Now set the GAZ (Gaze, time waiting for a signal to come up after stopping on a frequency, expressed in milliseconds) by depressing button below GAZ on the display by using the arrow keys or main tuning knob Now depress SET to enter value. Depress EXIT.
10	Now set the DWL (Dwell, time receiver stays on a frequency after signal detection, expressed in milliseconds). SET in the value, then press EXIT.
11	Now set the DED (Deadtime, time receiver stays on a frequency after signal presence goes away, expressed in milliseconds) SET in the value, then press EXIT.

Step 11 concludes the F1-F2 Frequency Scan Mode set-up procedure.

> Note: For GAZ, DWL and DED, a value greater than 00050 must be entered….a 00000 value is invalid and may cause the Scan Mode to malfunction (RCU lock-up).

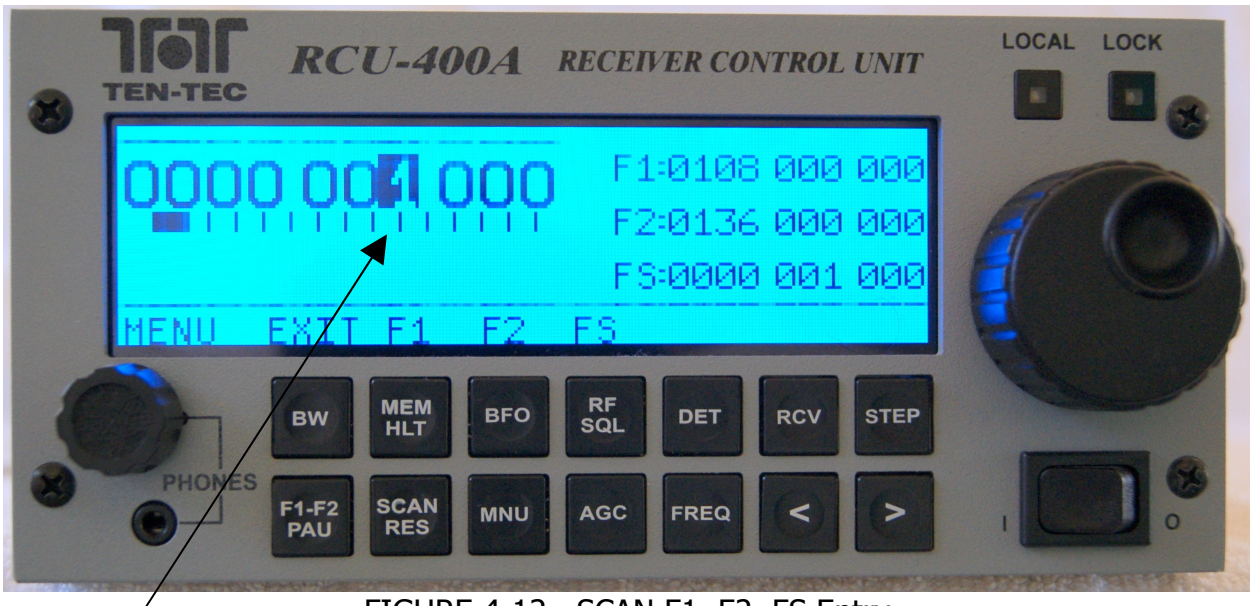


FIGURE 4-12 SCAN F1, F2, FS Entry

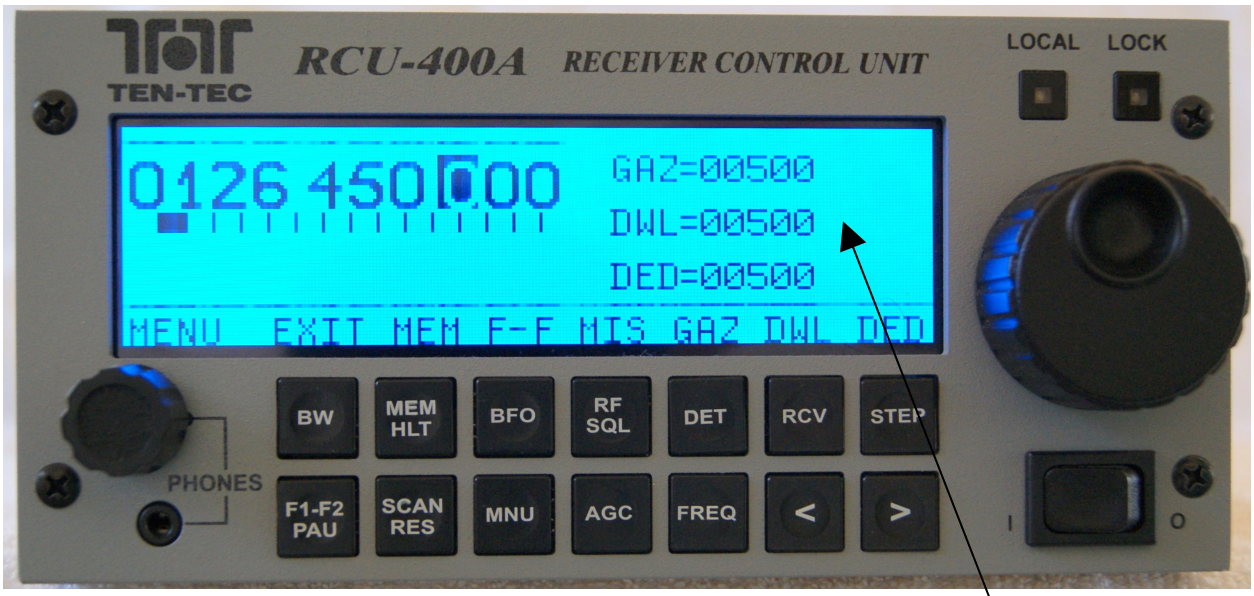


FIGURE 4-13 Gaze, Dwell and Dead-time

Showing times of 500 milliseconds set in for each value

4.4.4.10 Scan Mode Operation

With the F1 (Start), F2 (Stop), FS (Frequency Tune Step Size), GAZ (Gaze time), DWL (Dwell) and DED (Deadtime) parameters set-up and entered, the F1-F2 Scan Mode is initiated by depressing the SCAN/PAU button. This will bring up the Scan screen. Then push the button under F-F on the display. Now the receiver will begin scanning, starting at the F1 frequency and stepping through frequency increments determined by the FS setting. Assuming there are no signal levels above the set SQL threshold, the scan continues, at a rate established by the GAZ setting, to the next frequency, and finally to the F2 frequency, and then starts the scan again at the F1 frequency. F-F SCAN ACTIVE is displayed above the frequency readout.

Every time the scan encounters a signal above the threshold level, the scan will stop on that signal for a duration determined by the DWL and DED settings. At this point the operator may stop the scan at this point by pressing HLT. This allows the operator to monitor the signal. Or, when in HLT, the operator can lock out this frequency from future runs of this scan routine by pushing L/O. On the next scan run this frequency will be deleted from the run. To resume the scan routine, push F-F again to run the Scan mode.

To end the F1-F2 Scan Mode, push the button below the EXIT display. This will return the receiver to the Manual Tune Mode. Figure 4-14 shows a typical F1-F2 Scan display and Figure 4-15 provides a flow chart for the F1-F2 Scan Mode.

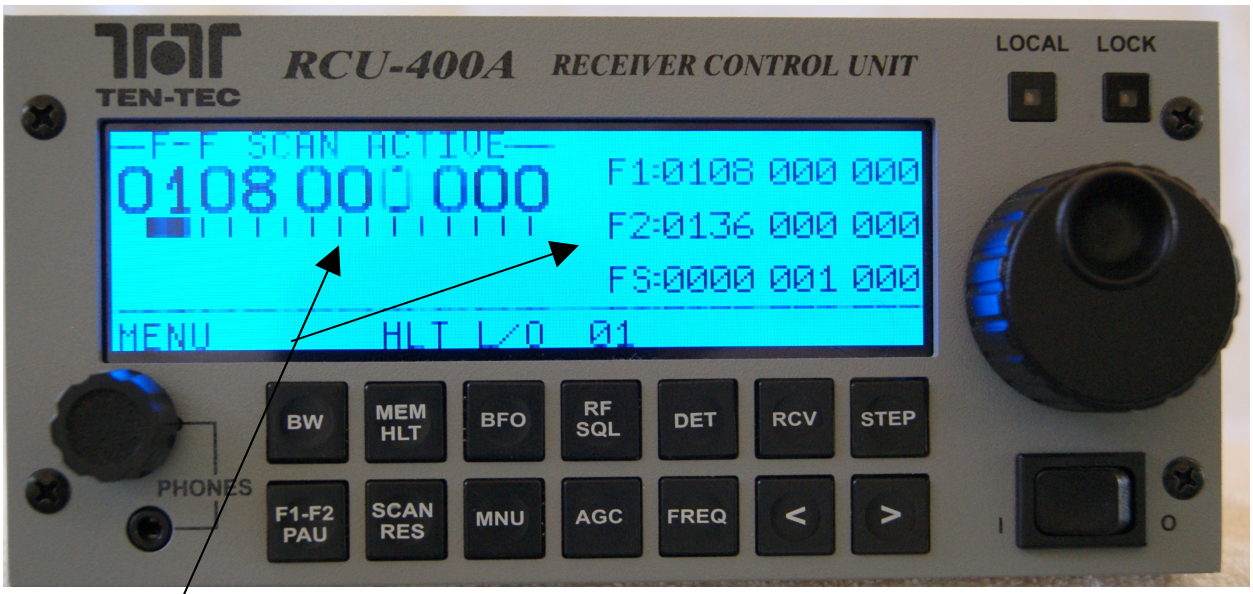


FIGURE 4-14 F1-F2 SCAN MODE

Showing receiver starting scan mode at F1=108 MHz,
with F2=136 MHz, and a frequency step of 1kHz.

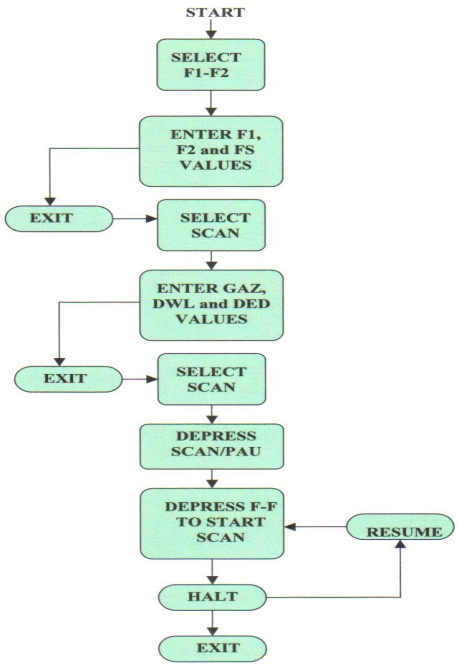


FIGURE 4-15 F1-F2 SCAN MODE FLOW CHART

Steps required to set up the Memory Channel Scan Mode are listed and described in Table 4-4. Refer to Figure 4-16 to view the Memory Channel Set-Up screen.

Step Number	Action
1	In the Manual tune mode select the frequency, detection mode, IF bandwidth, AGC mode and RF gain/Squelch settings. This 'set' will be the parameters stored into the first memory channel.
2	Push SCAN/RES button. Depress button below MEM display. This brings up the Memory screen
3	With the main rotary control or arrow keys select the memory channel that is to be loaded. Generally start at 01. Push the button below the STR display. This stores the first Frequency into memory channel 01.
4	Push EXIT, then set up the next frequency and operating parameters as in step 1. Then repeat step 2. Repeat step but increment the channel number to 02. Repeat these steps up to channel 99. This action manually loads a

		mission into the receiver. Push EXIT.
	5	To verify the memory contents, depress MEM, select memory channel number and depress the button under RCL. Repeat for each memory channel.
	6	To clear any memory channel of its content, select memory channel number and depress the button under the CLR display
	7	To conclude the memory channel set up, depress EXIT.

TABLE 4-4 Memory Scan Mode Set Up

Notes: (1) Provision to access 100 memory channels (00-99) is currently installed in RX-400A receivers, although the receiver contains 1000 memories. Future revision will expand access to 1000 channels.
(2) For Memory Channel Scan Mode, set up for GAZ, DWL and DED required, same as for F1-F2 Scan. See 4.4.4.9

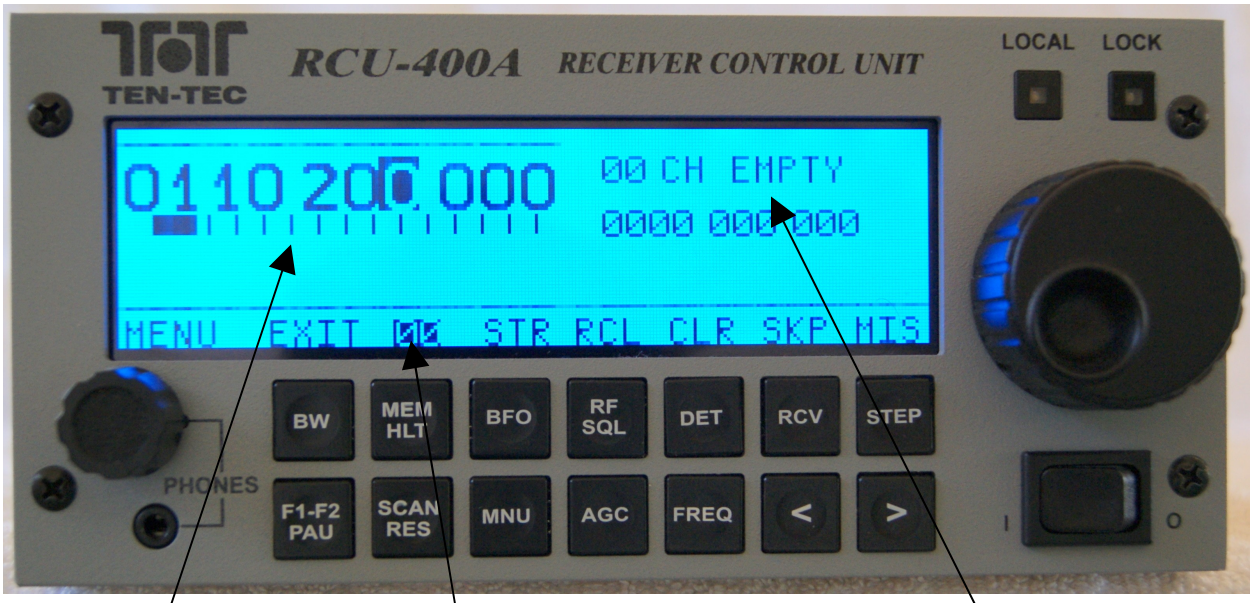


FIGURE 4-16 Memory Channel Scan Mode Set-Up

4.4.4.12 Memory Channel Scan Operation

To run the Memory Channel Scan Mode depress the SCAN/RES button. From the display selection push the button under MEM. This starts the Memory Channel Scan Mode and CH SCAN ACTIVE will be displayed above the frequency readout.

The scan will stop on frequencies having signal levels above the threshold set by the squelch (SQL) control. If there is no signal at a channel the receiver will remain on that channel unit the GAZ time has expired, upon which the channel scan will resume. If the receiver stops at a channel with a signal, the operator can monitor the signal to determine if he wants to halt the scan by depressing the button under HLT, or he can push the button under SKP to remove this frequency from the scan list. This is accomplished by pushing SKP and then SCAN/RES. The skipped channel will not show up on future memory channel scans.

GAZ, DWL and DED function the same as for the F1-F2 Scan Mode. To stop the memory channel scan mode depress EXIT. This returns the receiver to the manual tune mode.

Refer to Figure 4-17, it depicts a typical screen for the Memory Channel Scan Mode. Figure 4-18 provides a flow chart for the Memory Channel Scan Mode.

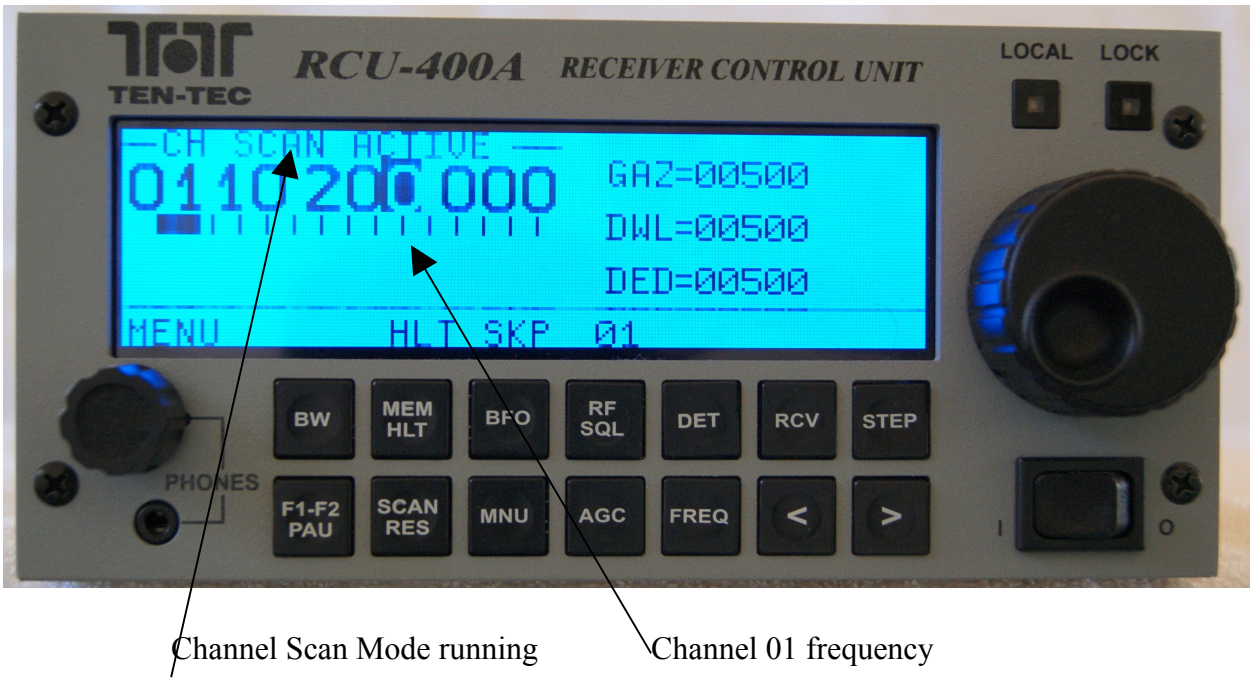


FIGURE 4-17 Memory Channel Scan Mode

4.4.4.13 Local and Lock Buttons

The LOCAL and LOCK buttons are located above the main tuning knob. The LOCAL button controls the source of the RCU's data display. When the LOCAL LED is illuminated, The RCU data is used. When the LOCAL LED is out, the data from the receiver is used. The LOCK button locks the main tuning knob shaft encoder outputs so turning the knob will not alter receiver frequency settings. The button illuminates when pushed.

4.4.4.14 MIS Softkey Function

With reference to Figure 4-13, the MIS softkey, using the global GAZ, DWL, DED times and squelch threshold setting, allows the operator to enter up to 100 mission scan sets where a 'mission set' can contain up to 100 memory channels. Depressing the MIS button activates the mission scan routine. Depressing HLT returns the RCU to the previous operating mode.

IMPORTANT OPERATIONAL NOTE - MEMORY CLEAR FUNCTION
Upon power down of RCU-400A and RX-400A Receivers
all memory channel contents are cleared.
This feature provides data security

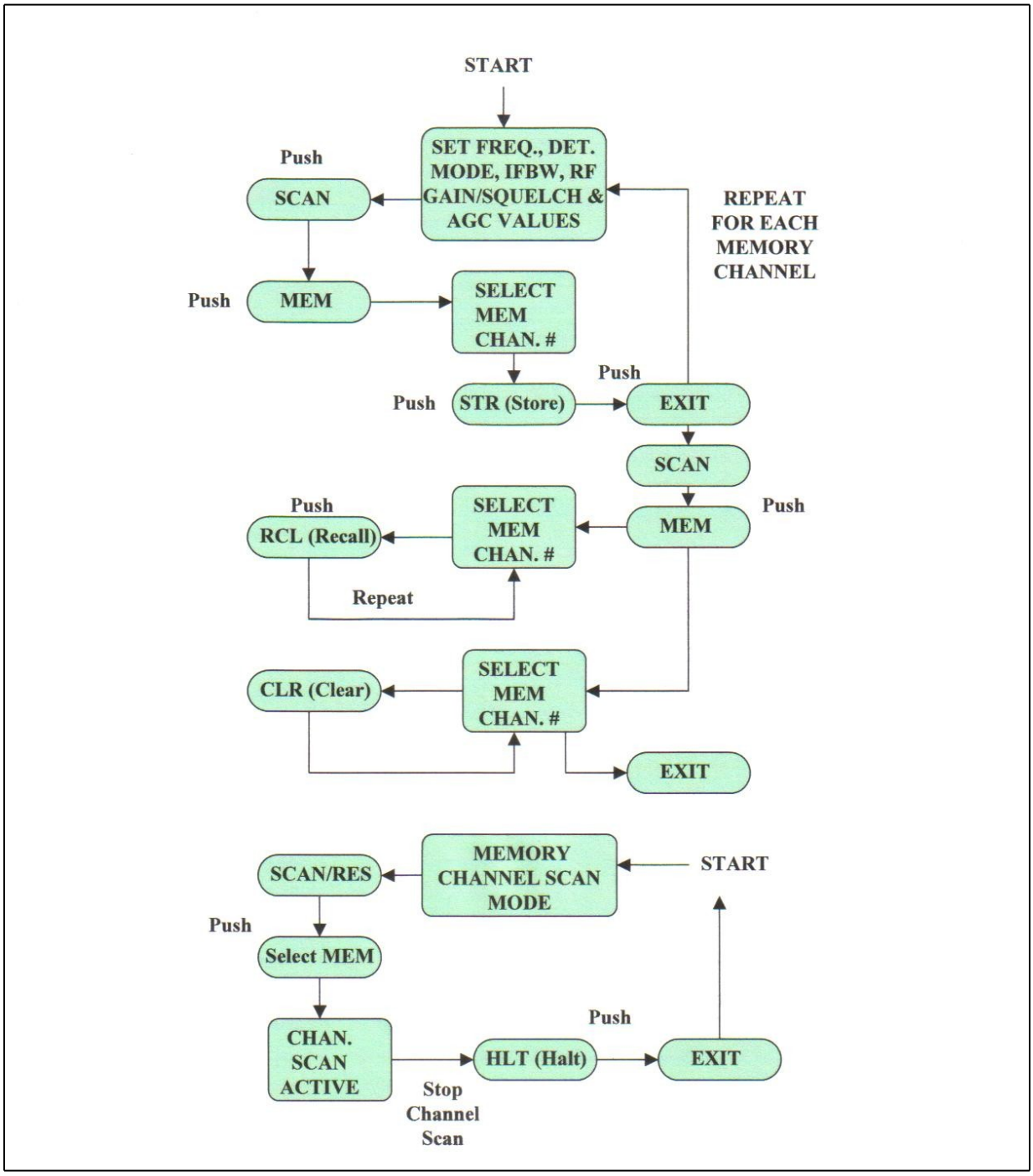


FIGURE 4-18 Memory Channel Scan Mode Flow Chart

5.0 THEORY OF OPERATION

5.1 OVERVIEW

The Ten-Tec model RCU-400A is a DSP and micro-Processor based Receiver Control Unit with a Front panel LCD and full complement of controls to provide manual operation of companion RX-400A HF/VHF/UHF Receivers.

The RCU contains a main Logic/DSP assembly which is the heart of the unit in terms of determining the development of receiver commands and presenting receiver operating parameters to the front panel display, an 8-port Ethernet switch, a RS-232 interface, an Ethernet interface, a LCD display/front panel controls assembly and an AC power supply. The overall internal functions are shown in FIGURE 5-1 below.

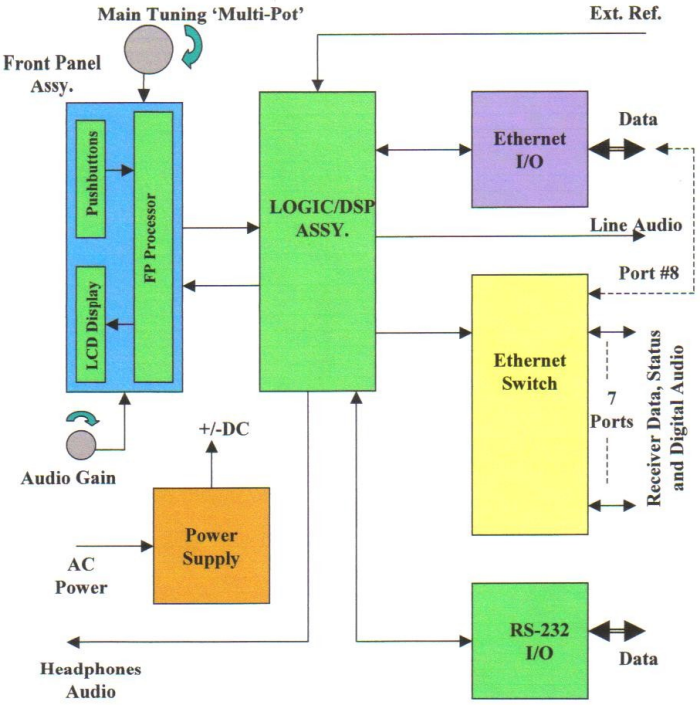


FIGURE 5-1 RCU-400A BLOCK DIGRAM

5.2 CIRCUIT DESCRIPTIONS

A brief working description of each major functional assembly follows and is intended to provide the user with a basic understanding of the RCU-400A design.

5.2.1 Logic/DSP Section

This assembly forms the core of the RCU-400A as it generates and assembles command words that are used to control the RX-400A receivers. It contains a 32-bit micro-processor, Xilinx PLD and 21364 DSP integrated circuit that interfaces with the front panel assembly, Ethernet I/O and RS-232 I/O. The interface with the I/O circuits is comprised of command data to/from and digital audio streams from RX-400A receivers (in the case of the Ethernet I/O). The front panel assembly feeds the Logic/DSP section with receiver control parameter values from its main rotary control and pushbutton switches. These control inputs are converted into command words for transmission to the RX-400A receivers via the Ethernet switch. The Logic/DSP section also contains D/A converters to re-construct the digital audio streams into analog headphone and line audio outputs. The Logic/DSP section also has an internal clock reference oscillator for the processor, and will accept an external reference of 1, 2, 5 or 10 MHz should the application require a common external for all system devices. On board regulators provide +1.2V and +3.3V for the DSP core.

5.2.2 Ethernet Switch

The built-in Ethernet switch is a 'smart' type switch with 8 RJ-45 ports. 7 of the ports are used for connection to RX-400A receivers and the 8th port is used to connect the switch to the RCU via its Ethernet jack. The switch automatically searches for receivers on its ports. When the RCU has established connection to one of the configured receivers through the switch it stops the search process and displays the settings of the RX-400A receiver it is communicating with. If the application calls for other than the normal 'local' sub-network, where connection is required to an external network via a server or another switch, then the RCU internal Ethernet switch will manage the data flow between the units and isolate the RCU/RX traffic from the outside network.

5.2.3 Serial Interface

The RCU-400A has a RS-232 serial interface using a rear panel 9-pin D connector. This port is generally used to install or update RCU firmware. This port transmits and receives full duplex standard ASCII-standard encoded characters. Baud rate for the interface is selected using the rear panel configuration dip switch. Chapter 7, paragraph 7.2 lists the baud rates and associated switch positions as well as data word frame formats.

5.2.4 Display and Keyboard Section

The front panel assembly of the RCU-400A is comprised of an LCD display, its driver circuitry, a main tuning knob shaft encoder, a headphone volume shaft encoder, and 14 pushbuttons that represent specific receiver control functions. The display receives RX-400A operating parameters from the Logic/DSP section via an on-board front panel micro-processor that formats the data for correct presentation on the LCD. The LCD is a multi-line alpha-numeric display having a blue backlight that provides a good contrast between the characters and background. The main rotary control is a ninety degree shift leading edge triggered shaft encoder that outputs pulses representative of the direction and speed of the knob. These pulses are interpreted by the front panel processor which sends correctly formatted serial words to the Logic/DSP section. The 14 pushbuttons are arranged in a two dimensional matrix where pushbutton action is coded to reflect sequential operations for use by the Logic/DSP section to form receiver command words.

5.2.5 Power Supply

The RCU-400A power supply delivers +/-12V and +/-5V to the Logic/DSP section as well as regulated voltages required by the Ethernet Switch, Ethernet interface, RS-232 interface and front panel assembly. The power supply is a universal design that runs from a 90 to 260VAC single phase source with a frequency between 48 and 440 Hz.

6.0 FIRMWARE LOAD AND UPDATE PROCEDURES

6.1 INTRODUCTION

The RCU-400A Receiver Control Unit is delivered from the factory with operating firmware installed. While the firmware is the latest version available at time of manufacture, updates may become available at the time of Receiver installation or periodically over the life of the equipment.

Firmware is available for download from the TEN-TEC, Inc. by contacting the factory.

6.2 REQUIRED APPLICATION TOOLS

To load firmware updates into the RCU-400A requires the TEN-TEC Flash Update Utility tool. This tool is available by contacting the factory. Upon receipt load the utility onto the desktop screen of the laptop or PC. This update utility will run on Windows 2000, XP or Vista operating systems.

The RCU-400A firmware updates are loaded via the RCU's RS-232 port. Loading the firmware requires a Serial Driver installed in the laptop or PC being used to perform the download.

6.3 FIRMWARE LOAD/UPDATE STEPS

To load firmware into the RCU-400A Receiver Control Unit perform the following steps:

1. Turn RCU-400A power to OFF.
2. With reference to paragraph 3.7 of this manual, place the #1 switch of the left hand Configuration Dip Switch section to the 'down' position.
3. Connect a serial cable from the RCU RS-232 connector to a USB port on the laptop or PC.
4. Turn the RCU power ON.
5. Click and open the Update utility icon on the laptop or PC desktop.
6. Click 'Settings', then click 'Setup'.
7. On the setup window 'check' the serial port box.
8. Select the COM port you want to use.
9. Note the IP address, UDP port and radio pass-code entries.
10. Click OK.

Firmware Load/Update Steps (cont'd)

11. Now click 'Process' on the Flash Utility window.
12. Click on 'Update Radio'.
13. A 'select Firmware Update File' window appears.
14. Select 'Look In:' Desktop.
15. Scroll down through the listing until the desired '*ruf' file is located.
16. Highlight the file, then click 'Open'
17. The load preamble text will be displayed, then the 'Erase' steps will occur and the firmware will then load 4096 lines of new firmware code.
18. Upon completion of download a 'successfully loaded' window will appear.
19. Close the application.
20. Place the Receiver power to OFF.
21. Disconnect the serial cable.
22. Return the #1 configuration switch to the 'UP' position.
23. Turn RCU power ON. This concludes the firmware update procedure.

7.0 RECEIVER CONTROL UNIT INTERFACES

7.1 INTRODUCTION

This chapter describes the RCU-400A control interfaces and the associated command set. All features of companion RX-400A Receiver(s) are controllable through the interfaces by command words generated by the RCU. In addition, the Ethernet interface provides audio streaming from the receiver to the RCU-400A Receiver Control Unit or PC or any device that can process variable sample rate PCM data delivered via UDP packets. Mission Downloads may also be passed to Receivers from a host PC or Workstation via the RCU using the Ten-Tec, Inc. MDS-4001 (L3 P/N 09CD0189-001) software package.

7.2 SERIAL INTERFACE DESCRIPTION

The RCU-400A Receiver Control Unit has the capability to accept commands via a host computer or other controller that is equipped with a RS-232 interface or an Ethernet port and capable of transmitting and receiving ASCII-standard encoded characters. A baud rate hardware configuration can be selected via switches 2 and 3 of the Configuration DIP switch.

The RS-232 interface of the RCU-400A is physically implemented on a rear panel standard 9-pin D connector. This interface has a full duplex operation, meaning that it can transmit and receive data simultaneously.
The baud rates are selectable via configuration dip switches SW2 and SW3. Refer to Table 7-1.

Baud Rate		
	Sw1/Switch 2	Sw1/Switch3
1200	0	0
9600	0	1
19200	1	0
57600 **default**	1	1

Table 7-1 Baud Rate Switch Settings

The RCU-400A is set up with a fixed data word frame format consisting of ten bits, and comprised of the following:

- one start bit,
- an eight-bit character
- no parity,
- one stop bit

An example illustration of the fixed data word format is shown below.

Start Bit	**Bit 0**	**Bit 1**	**Bit 2**	**Bit 3**	**Bit 4**	**Bit 5**	**Bit 6**	**Bit 7**	**Stop Bit**

It is important in serial data transmissions that the receiving device knows when data is being transferred and when data being transferred is about to stop. This information is conveyed by the above start and stop bits. The start bit synchronizes the receiving device so it reads the data properly. The stop bit notifies the receiving device that the data frame has ended. The RCU-400A's fixed data word frame format does not contain a parity bit.

7.2.1 Communications Protocols

Data transfers are handled via input and output buffers. The input buffer is handled in circular fashion allowing simultaneous inputting and processing of data. The input buffer accepts up to 256 bytes before overflowing. As data in the buffer is being processed, up to 16 additional characters can be accepted by the unit. Upon receiving a terminator character, the RCU-400A processes any previous messages in the buffer. The input buffer processing starts on the receipt of a terminator (CR). If the communications error flag is set, the buffer contents from the end of the last processed message thru the message terminator are discarded. In the event the buffer is overrun, its contents are discarded. All other incoming data is buffered and processed in the order in which it was received. If the radio does not understand a command sequence or the command is badly formatted, the radio will respond with a 'Z' followed by a carriage return.

The output buffer is handled in circular fashion allowing simultaneous additions and outputting.

7.3 COMMAND MESSAGE FORMATTING

Command messages for the RCU-400A are exclusively ASCII-encoded data, consisting of command headers and arguments. Command headers consist of a two character (letter-digit) mnemonics. All queries consist of a question mark (?) followed by a command header. All set commands consist of an asterisk (*) followed by a command header.

7.4 TERMINATORS FOR COMMANDS AND QUERIES

Terminators are used to signal the end of a command or string. When a properly formatted message is ready to be sent, a CR (carriage return) character should be entered. The CR character instructs the receiver to process the preceding messages.
The RCU-400A also transmits a terminator when responding to queries. After the query response is transmitted the receiver issues a CR (carriage return) indicating the end of the response.

7.5 FORMATS OF QUERY RESPONSES

The RCU-400A transmits responses to queries in a fixed-field format. Query responses begin with the letter-digit mnemonic of the query in upper-case characters, followed by an alphanumeric argument. Numeric arguments are represented by the least number of digits possible, while still representing the entire range of the value. If a negative value is allowed for the argument, a positive or negative sign is always given. Multiple responses to a query are valid but are separated by a CR character.

7.6 CONTROL PARAMETERS

Various receiver parameters can be controlled and /or monitored over the RS-232 or Ethernet interface. See Table 7-2 below for supported control commands. Note: All commands are 2 ASCII characters.

TABLE 7-2 COMMAND PARAMETERS

Description	Set Command	Query Command
Set Attenuator	*A0	?A0
BITE Level 1	*B1	Not Applicable
BITE Level 2	*B2	Not Applicable
BITE level 3	*B3	Not Applicable
Store Memory Channel	*C0	Not Applicable
Set Manual Attenuation	*C1	?C1
BFO	*C2	?C2
Bandwidth	*C3	?C3
Store Sweep Range	*C4	?C4
Automatic Gain Control	*C5	?C5
Detection Mode	*C7	?C7
Memory Recall	*C8	Not Applicable
Software Reset	*C9	Not Applicable
Load EEprom Defaults	*D1	Not Applicable
Reset AGC Settings	*D2	Not Applicable
Stop Ethernet Audio RIP	*E0	Not Applicable
Start Ethernet Audio RIP	*E1	Not Applicable
Set Ethernet IP Address	*E2	?E2
Set Base UDP Port	*E3	?E3
Set Gateway Router IP Address	*E4	?E4
Disable Ethernet Communications	*E5	Not Applicable
Enable Ethernet Communications	*E6	Not Applicable

Table 7-2, Continued

Tune Frequency	*F1	?F1
Start /End Frequency Range for Frequency Scan	*F2	?F2
Start/Halt/Pause/Resume Frequency Scan	*F3	?F3
Frequency Step	*F5	?F5
Add/Delete Lockout Frequency	*F6	?F6
Add/Delete Lockout Frequency Range	*F7	?F7
Add Lockout Frequency Range	*F8	?F8
Set Attack Rate	*G1	?G1
Set Decay Rate	*G2	?G2
Set Hang Time	*G3	?G3
Unit Serial Number	Not Applicable	**?I1**
Firmware Version	Not Applicable	?I2
Fault Status	Not Applicable	**?I3**
Extended Firmware Info	Not Applicable	?I4
Recall Memory Channel	*P0	?P0 (report only)
Store current parameters in Memory Channel	*P1	Not Applicable
Memory Scan Channel Range Start/Stop	*P2	?P2
Memory Scan Channel Skip/Add	*P3	?P3
Memory-Scan Channel Halt/Pause/Resume	*P4	Not Applicable
Set Squelch Level	***S1**	**?S1**
Report Signal Strength	***S3**	**?S3**
Squelch Status	Not Applicable	**?S4**
Dwell Timer	*T1	?T1
Dead Time	*T2	?T2
Gaze Time	*T3	?T3
S-Meter Hold off Time	*T4	?T4
Set Carrier Loss Time	*T5	?T5
Set Transient Time	*T6	?T6
Disable Multi Address mode	*U1	?U1
Enable Multi Address Mode	*U2	?U2

7.6.1 Command Descriptions

The following will define a functional description of each control command or query command sent out from the RCU to companion RX-400A Receiver(s).

Hardware HF Attenuator On/Off

Controls the hardware attenuator. This attenuator is active in the HF bands only.

Format: **(Set command)** ***A0n<cr>**
(Get command) **?A0<cr>** **Response: A0n<cr>**

1)

Definitions:
N= 1 or 0, where 1 turns the attenuator on and 0 turns the attenuator off.

BITE, System Self Test (B!,B2,B3)

Initiates the BITE process. When completed, the system will report PASS or FAIL.

Format: **(Set command)** ***Bn<cr>**

1) **The system will run internal diagnostics and report PASS or FAIL.**

Definitions:
N= 1,2 or 3,

Store Memory Channel

Stores current operating Frequency and Detection Mode to the indicated memory channel

Format: **(Set command)** ***C0nnn<cr>**

Definitions:

1) **n=3 digit memory channel 0 to 999.**

Set Manual AGC Attenuation

Sets the amount of AGC attenuation to apply. Adjusts from 000-120 dB range with 0.10 dB resolution. Can be set in any mode. Receiver gain is reduced and AGC threshold is increased by the number of dB indicated.

Format: **(Set command)** ***C1AAAD<cr>**
(Get command) **?C1<cr>** **Response: C1AAAD<cr>**
1)

Definitions:

AAA= 000-120 represents the amount of attenuation in db. Range 000-120
D=represents .10 resolution for the attenuation. Example: 107.8 dB attenuation will be entered as 1078. Decimal point is not allowed.

BFO (C2)

Format: **(Set command)** ***C2nnnn<cr>**
(Get command) **?C2nnnn<cr>**

Definitions:

For CW detection mode operations, The Beat Frequency Oscillator (BFO) capability is available. The BFO is adjustable over a +/- 8192 Hz range in 1Hz steps. The BFO frequency can be applied to the received CW signal to alter its audio pitch as a detection aid. The BFO and passband frequencies are respectively selected by the BFO commands.

Bandwidth (C3)

The operator may select one of 18 available IF bandwidth filters.

Format: **(Set command) *C3BB<cr>**
(Get command) ?C3<cr> Response: C3BB<cr>

Definitions:
BB selects the desired bandwidth using 2 ASCII decimal digits. See Table 7-3 for Filter selections. Note: Filter numbers are 2 ASCII digits. Example <0><0> for filter number 0.

Filter Number	Bandwidth	Filter Number	Bandwidth
00	300khz	**10**	20khz
01	240khz	**11**	15khz
02	180khz	**12**	10khz
03	150khz	**13**	6khz
04	100khz	**14**	5khz
05	60khz	**15**	3khz
06	50khz	**16**	2khz
07	35khz	**17**	1khz
08	30khz	**18-27**	900-100hz
09	25khz		

Table 7-1 Bandwidth Filters

Store Current Parameters in Sweep Range A-H (C4)

Format: **(Set command) * C4<cr>**
(Get command) ?C4<cr>
Definitions:

Automatic Gain Control (C5)

The receiver provides 3 preset Automatic Gain Control rates and a programmable AGC mode. The operator may select Slow, Medium, Fast or Programmable via the C5 command. The three modes are selected as defined:

Format: **(Set command)** ***C5X<cr>**
(Get command) **?C5<cr>** **Response: C5X<cr>**

Definitions:
X =<S>-- select SLOW mode <M>--selects MEDIUM mode <F>--selects FAST mode
<P>--Programmable Mode
Default--<M> MEDIUM setting
If programmable mode is selected, the radio will use the value entered via the G1,G2 and G3 (Set Attack, Decay, Hang Rate) command.

Detection Mode (C7)

Format: **(Set Command)** ***C7M<cr>**
(Get Command) **?C7<cr>**

Definitions:

M=<A>=AM, <U>=USB, <L>=LSB, <C>=CWU, <W>=CWL, <F>=FM, <K>=FSK

The detection mode command determines how the signal is to be demodulated. The Receiver Supports AM, USB, LSB, CWU, CWL, FM and FSK detection modes.

Memory Recall (C8)

Format: **(Set command)** *** C8nnn<cr>**
(Get command) **?C8nnn<cr> where nnn is value between 0 and 999**
Definitions: This command recalls contents of previously loaded memory channels. If memory channel is empty then no action is taken.

Format: **(Set command)** ***C7M<cr>**
(Get command) **?C7<cr>** **Response: C7M<cr>**

Definitions:
M= <A>=AM, <U>=USB, <L>=LSB, <C>=CWU, <F>=FM , <W>=CWL, <K>-= FSK

The detection mode command determines how the signal is to be demodulated. The receiver supports AM, USB, LSB, CWU, FM, CWL, FSK detection modes. The detection mode will be selected for the current frequency selected by the receiver. AUTO MODE??

Software Reset (Reboot) Unit (C9)

Format: **(Set command)** ***C9<cr>**
(Get command) **(Not applicable)**

Definitions:

This command will perform a soft reboot to the receiver. The unit will be initialized as if the power were removed. The ASCII string "RADIO START" will be transmitted by the radio when reset is complete.

Load EEprom Defaults (D1)

Format: **(Set command)** ***D1PPPPP<cr>**
(Get command) **(Not applicable)**

Definitions:
PPPPP is the 5 ASCII digit pass code that must be entered to download default values to EEprom and is defined as:

12461

This command will load all defaults settings to EEPROM. A valid five character password must enter with this command before the command will be accepted.
NOTE: This command could take up to 10 seconds to complete. The user should wait for the ASCII string "RADIO START" that will be transmitted by the radio when the download is complete.

AGC Dump (D2)

Format: **(Set command)** ***D2<cr>**
(Get command) **(Not applicable)**

Definitions:
This command will terminate the current AGC state and refresh the AGC system. This will cancel HANG or DECAY in process. This is most effective for canceling a long AGC recovery delay that may be suppressing the receiver gain and reducing sensitivity.

Stop Ethernet Audio Rip (E0)

This command stops the transmission of RIP (Radio over IP) audio via Ethernet UDP protocol.

Format: **(Set command) * E0<cr>**
(Get command) (Not applicable)

Definitions:

Start Ethernet Audio Rip (E1)

This command starts the transmission of RIP audio ethernet packets. This command must be sent out a minimum of every 5 seconds for the unit to continue to send rip packets via ethernet.

Format: **(Set command) * E1<cr>**
(Get command) (Not applicable)

Definitions:

Set Ethernet IP Address (E2)

Format: **(Set command) *E2AAA<dot>BBB<dot>CCC<dot>DDD<cr>**
(Get command) ?E2<cr>
Response: E2AAA<dot>BBB<dot>CCC<dot>DDD<cr>

Definitions:
AAA—The 1st octet of the IP address. Range 0-255
BBB—The 2nd octet of the IP address Range 0-255
CCC—The 3rd octet of the IP address Range 0-255
DDD—The 4th octet of the IP address Range 0-255
The octet addresses can be specified using 1, 2, or 3 digits. If less than 3 digits are specified for the octet address, a "dot" character<0x2E> must sent between the octets to differentiate between address values.

Set Base UDP Port (E3)

Format: **(Set command)** *** E3NNNNN<cr>**
(Get command) **?E3<cr>** **Response: E3NNNNN<cr>**

Definitions:
This command will set the 5 digit UDP port value for the radio.
NNNNN- valid range 0-65520.

Set Gateway Router IP Adress (E4)

Format: **(Set command)** *** E4AAA<dot>BBB<dot>CCC<dot>DDD<cr>**
(Get command) **?E4<cr>**
Response: E4AAA<dot>BBB<dot>CCC<dot>DDD<cr>

Definitions:
AAA—The 1st octet of the gateway IP address. Range 0-255
BBB—The 2nd octet of the gateway IP address Range 0-255
CCC—The 3rd octet of the gateway IP address Range 0-255
DDD—The 4th octet of the gateway IP address Range 0-255
The octet addresses can be specified using 1, 2, or 3 digits. If less than 3 digits are specified for the octet address, a "dot" character<0x2E> must sent between the octets to differentiate between address values.

Disable Ethernet Communications Port (E5)

Format**:** **(Set command)** ***E5<cr>**
(Get command) **(Not applicable)**

Definitions:
This command will disable Ethernet communications.

Enable Ethernet Communications Port (E6)

Format: (**Set command)** ***E6<cr>**
(Get command) **(Not applicable)**

Definitions:
This command will enable Ethernet communications.

Tune Frequency (F1)

The F1 command allows the tuned frequency of the RX-400A to be set to any value between 100kHz and 3 Gigahertz in 1-Hz increments.
S
Format**: (Set command)** *** F1FFFFFFFFFF<cr>**
(Get command) **?F1<cr>** **Response: F1FFFFFFFFFF<cr>**

Definitions:
FFFFFFFFFF-Selects the frequency to tune in hertz entered as10 ASCII/decimal format. Leading zeros can be omitted. Range 100kHz to 3 GHz

Example:
To tune a frequency of 235.67 MHz the value 235670000 will be entered.
To tune a value of 2 MHz 2000000 can be entered.

Start/End Frequency (F2)

This command is used to select the start and end frequency range for P-SCAN mode which allows the radio to search for activity in a given frequency range.

Format: **(Set command)** *** F2SSSSSSSSSS<dot>EEEEEEEEEE<cr>**
(Get command) **?F2<cr>**
Response: F2SSSSSSSSSS<dot>EEEEEEEEEE<cr>

Definitions:
SSSSSSSSSS --Selects the starting frequency in hertz. The value entered in 10 ASCII /decimal format. Leading zeros can be omitted but the <dot> character must be transmitted to differentiate between the start and end frequency values. Range 100kHz-3 GHz
EEEEEEEEEE-- Selects the ending frequency in hertz. The value entered in 10 ASCII /decimal format. Leading zeros can be omitted. Range 100kHz-3 GHz

Start/Halt/Pause/Resume Frequency Scan (F3)

Format: **(Set command) * F3X<cr>**
(Get command) ?F3<cr> Response: F3X<cr>

Definitions:

X = <S> start programming frequencies for the specified range using command F2. If no range has been specified using command F2, the receiver, the valid range will be from 0-3Ghz in 1hz increments if no step size is specified via command F5. If command F5 has been received, the receiver will use the step size specified in that command.

<H> halts or stops frequency scanning and returns to manual mode. The receiver will remain tuned to frequency it is currently set to when receiving this command.

<P> Scanning will pause scanning if currently in scan mode. This command is ignored if not currently in scan mode.

<R> resumes frequency scanning if currently in "paused" mode. Ignores this command if not currently in paused mode

Frequency Step (F5)

Sets the step size of frequency scan (1 Hz steps) in P-SCAN mode

Format: **(Set command) *F5FFFFFFFFF<cr>**
(Get command) ?F5<cr> Response: F5FFFFFFFFF<cr>

Definitions:

FFFFFFFFF-Selects the step size in hertz entered in ASCII/decimal format. Leading zero's can be omitted. Range 1 Hz-3 GHz

Add Lockout Frequency (F6)

Format: **(Set command)** ***F6NNFFFFFFFFFF<dot>BBBBBB<cr>**
(Get command) **?F6NN<cr>**
Response: **F6NNFFFFFFFFFF<dot>BBBBBB<cr>**

Definitions:
NN= Specifies the record number where the lockout frequency is stored. Valid record numbers 0-49.
Note: If NN value is 00 the radio will respond with all the record numbers and values that are programmed in the following format:
F6NNFFFFFFFFFF<dot>BBBBBB<cr>
F6NNFFFFFFFFFF<dot>BBBBBB<cr>
F6NNFFFFFFFFFF<dot>BBBBBB<cr> …..etc.
:
FFFFFFFFFF=specifies the 10 digit ASCII/decimal frequency value to lock out when tuning. Leading zeros can be omitted but the <dot> character must be transmitted to differentiate between the frequency and the bandwidth values.
BBBBBB=specifies the 6 digit ASCII/decimal bandwidth to add/subtract from the specified

Delete Lockout Frequency (F7)

Format: **(Set command)** ***F7NN<cr>**
(Get command) **(Not applicable)**

Definitions:
NN= Specifies the record number in which to delete the lockout frequency value that is stored there 0-49.

Add Lockout Frequency Range (F8)

Format: **(Set command)** ***F8NNSSSSSSSSSS<dot>EEEEEEEEEE<cr>**
1) **(Get command)** **?F8NN<cr>**
1) **Response:**
F8NNSSSSSSSSSS<dot>EEEEEEEEEE<cr>

Definitions:
NN—specifies the record number 0-24
Note: If NN value is 00 the radio will respond with all the record numbers and values that are programmed in the following format:
***F8NNSSSSSSSSSS<dot>EEEEEEEEEE<cr>**
***F8NNSSSSSSSSSS<dot>EEEEEEEEEE<cr>**
1) ***F8NNSSSSSSSSSS<dot>EEEEEEEEEE<cr>**

SSSSSSSSSS- Specifies the starting frequency for the lockout range entered in ASCII/decimal format. . Leading zeros can be omitted but the <dot> character must be transmitted to differentiate between the leading frequency and the ending frequency values.
Range 0-3Ghz

EEEEEEEEEE- Specifies the ending frequency for the lockout range entered in ASCII/decimal format. Leading zero's can be omitted. Range 0 MHz-3 GHz

Set Attack Rate (G1)

Format: **(Set command) *G1NNNN<cr>**
(Get command) ?G1<cr>
Response: G1NNNN<cr>

Definitions:
NNNN=Valid range 0001-9999 in ASCII decimal format. Leading zeros can be omitted.

The attack rate is used in automatic gain control (AGC) to select the rate to raise the volume for weak signals to try to maintain an approximately constant average output level of varying signal levels.

Set Decay Rate (G2)

Format: **(Set command) *G2NNNN<cr>**
(Get command) ?G2<cr> Response: G2NNNN<cr>

NNNN=Valid range 0001-9999 in ASCII decimal format. Leading zeros can be omitted.

The attack rate is used in automatic gain control (AGC) to select the rate to lower the volume for strong signals to try to maintain an approximately constant average output level of varying signal levels.

Set Hang Time (G3)

Format: **(Set command) *G3NNNN<cr>**
(Get command) ?G3<cr> Response: G3NNNN<cr>

NNNN=Valid range 0001-9999 in ASCII decimal format. Leading zeros can be omitted.

Unit fault Status (I1)

Format: **(Set command)** ***I1KKKKKKKKKK<cr>**
(Get Command) **?I1<cr>**

Response: By single character letter code

KKKKKKKKKK – This will be a key code used in the set command to clear out all error codes logged in the unit. The key code will be a 10 character hard coded value used by Ten-Tec Service to clear out the error codes.

Error Code Definitions:
This command will report error codes and fault conditions via one alphabetic character that are logged by the firmware. They are defined as follows:
A=
B=
C=
D=

Firmware Version (I2)

Format: **(Set Command)** Not Applicable
(Get Command) **?I2<cr>** Response: **CCCCCCCCCCCCC<cr>**

Definitions:

This command will report the firmware version number. The following strings are defined and will be reported for the specific unit model numbers.

RX-400A Model:

VER<0x20>XXXX<0x5f>400<cr> Note: XXXX represents 4 digits that will increment with each Firmware version release

Format: **(Set command)** **(Not applicable)**

(Get command) **?I2<cr>** **Response:**
CCCCCCCCCCCCC<cr>

Definitions:

This command will report the firmware version number. The following strings are defined and will be reported for the specific unit model numbers:

RX400 model:

VER< 0x20>XXXX< 0x5f>400<cr> Note: XXXX represent 4 digits that will increment with each Firmware version release.

Unit Serial Number (I3)

Format: **(Set command)** **(Not applicable)**

(Get command) **?I3<cr>** **Response: I3SSSSSSSS<cr>**

Definitions:

This command will report the serial number assigned to each unit by Ten-Tec. The following format is defined:
To be determined

Extended Firmware Info (I4)

Format: **(Set command)** **(Not applicable)**
(Get command) **?I4<cr>** **Response: to be determined**

Store To Memory Channel (P0)

Stores current operating Frequency and Detection Mode to the indicated memory channel

Format: **(Set command)** *P0nnn<cr>
(Get command) ?P0nnn<cr> reports contents of memory channel without recalling the data.

Definitions:
1) **n=3 digit memory channel 0 to 999.**

Store Current Parameters in Memory Channel (P1)

Format: **(Set command)** ***P1CCCBBMSSRFFFFFFFFFF<cr>**
1) **(Get command)** **?P1CC<cr>** **Response:**
P1CCCBBMSSRFFFFFFFFFF<cr>

Definitions:
CC=Channel Number to assign parameters. Range 00-999 in ASCII/decimal format
BB=Selected IF Bandwidth filter number assigned to the specified channel number. Range: (See Table 5)
M=Selected detection mode assigned to the specified channel <A>=AM, <F>=FM, <U>=USB, <L>=LSB,

<C>=CWU, <W>=CWL, <K>=FSK
SS=Selects the desired squelch mode settings. Multiple squelch modes can be selected.
R=<A>=channel specified in command is added to the channel ring.
=<D>=channel specified in command is deleted from the channel ring.
FFFFFFFFF=Frequency to tune assigned to specified channel number. Range 100kHz-3 GHz Leading zero's can be omitted.

Memory-Scan Channel Start-Stop Range (P2)

Format: **(Set command)** ***P2SSSEE<cr>**
1) **(Get command)** **?P2<cr>** **Response:**
P2SSSEE<cr>

Definitions:
SS= Specifies the starting channel for the memory scan via two ASCII digits. Range 0-999.
EE= Specifies the ending channel for the memory scan via two ASCII digits. Range 0-999.

Memory Channel Skip/Add (P3)

Format: **(Set command)** ***P3CCCX<cr>**
1) **(Get command)** **?P3CCC<cr>** **Response:**
P3CCCX<cr>

Definitions:

CC=specifies the channel to be added or deleted to the memory list when scanning. Range 0-999
X= <A> adds the specified channel to the memory list when scanning.
= <S> removes the specified channel from the memory list when scanning.

Start/Halt Pause/Resume Memory Scan (P4)

Format: **(Set command)** ***P4X<cr>**
(Get command) **(Not applicable)**

Definitions:
X = <S> start scanning for activity on pre-programmed memory channels. The receiver will use the specified channel range via command P4. If no range has been specified using command P4, the valid channel range will be from 0-999.

NOTE: if no channels are found to be programmed, an error will be returned when the "S" is transmitted to start scanning.

NOTE: the time between scanning uses the time set in the Gaze Time (T3) command.

<H> halts or stops program scanning and returns to manual mode. The receiver will remain tuned to the channel it is currently set to when receiving this command.

<P> pauses channel scanning if currently in scan mode. Ignored if receiver not currently in scan mode.

<R> resumes channel scanning if currently in "paused" mode. Ignores this command if not currently in paused mode

Squelch Notes:

Unlike HF receivers, VHF/UHF receivers need noise squelch, window squelch and signal level squelch. It is not sufficient to rely on carrier to noise ratio alone to determine if signal is present in a channel.

Set Signal Strength Squelch (S1)

Format: **(Set command)** ***S1LLL<cr>**
(Get command) **?S1<cr>** **Response: S1LLL<cr>**

Definitions:
LLL—the level that will be compared to the current signal strength level used to determine if a valid signal is present. If the current signal strength is found to be less than this value, the signal is found to be invalid and the audio will be muted. Valid ranges 0-127. Leading zero's can be omitted.

Current Signal Strength (S3)

Format: **(Set command)** **(Not applicable)**
(Get command) **?S3<cr>**
Response: S3NNN<cr>

NNN= Current measurement of signal strength. Valid ranges 0-127

This command will report the current signal strength value that is updated in the firmware. This is the value that is compared to the squelch level set in the S1 command. If this value goes below the squelch level, the audio will be muted.

Squelch Status (S4)

Format: **(Set Command)** **(Not applicable)**
(Get command) **?S4<cr>**
Definitions: TBD

Dwell Timer (T1)

Format: **(Set command)** ***T1TTTTTTTT<cr>**
(Get command) **?T1<cr>** **Response: T1TTTTTTTT<cr>**
1)
Definitions:
TTTTTTTT= represents the time in ASCII/decimal format. Value = number of milliseconds. Valid ranges are 0-99999999.

The dwell time feature sets the duration of time the receiver will remain on an active channel. An infinite dwell time can also be selected. Setting the Dwell Time to 0 activates the INFINATE DWELL which forces the radio to remain on the frequency or memory channel as long as it is active (SQUELCH open).

Dead Time (T2)

Format: **(Set command)** ***T2TTTTTTTT<cr>**
(Get command) **?T2<cr>** **Response: T2TTTTTTTT<cr>**

TTTTTTTT= represents the time in ASCII/decimal format. Value = number of milliseconds. Valid ranges are 0-99999999.

Dead time refers to the time the radio will remain on a channel after activity has ended. The factory default is 8 seconds. If the DWELL TIME setting is less than the DEAD TIME setting the radio will resume scanning when the DWELL TIME timer runs out. If the DWELL TIME setting exceeds the DEAD TIME setting, scanning will resume when the DEAD TIME timer runs out.

Gaze Time (T3)

Format: **(Set command)** ***T3TTTTTTTT<cr>**
(Get command) **?T3<cr>** **Response: T3TTTTTTTT<cr>**

TTTTTTTT= represents the time in ASCII/decimal format. Value = number of milliseconds. Valid ranges are 0-99999999.

Gaze time is the time the radio will spend waiting for activity on each new channel or frequency. The factory setting is 50Ms. This time can be adjusted to control the rate of scan.

S-Meter Hold Off Time (T4)

Format: **(Set command)** ***T4TTTTTTTT<cr>**
(Get command) **?T4<cr>** **Response: T4TTTTTTTT<cr>**

TTTTTTTT= represents the time in ASCII/decimal format. Value = number of milliseconds. Valid ranges are 0-99999999.

This feature determines how long the radio will wait before checking channel activity after moving to a new frequency or channel. This time is necessary to allow the AGC system to settle down so an accurate measure of channel activity can be made. Factory defaults to 50ms.

Disable Multi-Addressing Switch Override (U1)

Format: **(Set command)** ***U1<cr>**
(Get command) **(Not applicable)**

Description:
This command disables the Multi addressing override mode. The firmware will set/clear multi addressing mode via Dip Switch SW1, switches 4-8. If all the switches are set to the ON position, multi addressing is disabled and the unit will respond to all commands. If the dip switches are set to any other position, multi address mode is enabled and the unit will respond only to commands that have the binary address selected via the dip switches of the unit. Switch 4 = MSB, Switch 8 = LSB.

Enable Multi-Addressing Switch Override (U2)

Format: **(Set command)** ***U2<cr>**
(Get command) **(Not applicable)**

Description:
When this command is received, the multi addressing mode is ignored and all the units connected on the serial or Ethernet bus assumes non multi addressing mode. The units will respond to all commands until they have been reset via the C9 command, power reset, or the U1 command.

Mission Download (to RCU) (M0)

Format: **(Set command)** ***M0<cr>**
(Get command) **(Not applicable)**

Description:
RR=Receiver Number, CC=Mission Memory Channel Number, MT=Memory Type is (R) Range or (C) channel. Command set downloaded from host PC/workstation with MDL Software package. Example: *M01, 02,R,0088000000,0108000000,0000100000,10,F,0, 040,F,99,88,77,10,50,90,21, where sequence is for fstart,fstop,fstep,filterBW,detection mode, rfgain,squelch,AGCmode,attack,decay,hang,gaze,dwell,deadtime,memory group<cr>

8.0 AUDIO STREAMING

8.1 RADIO OVER IP (RIP) DATA FORMAT

RIP is the system by which the RCU-400A receives real time streaming audio from companion RX-400A Receivers. The RIP packets are sent from the receiver via standard UDP packets. With each UDP packet containing a descriptive header and audio data block. The RIP UDP Packet is based on the Real Time Protocol (RTP). RTP is the format utilized by various commercial Voice Over IP systems. The format of the data packet used for RIP is as follows:

Octet 0	Header Information	0x80 = RTP Format
Octet 1	Header Information Continued	0x50
Octet 2-3	RTP Sequence	0xnn 0xnn
	Packet Counter (=last+1) used for verification of service	
Octet 4-7	RTP TimeStamp	0xnn 0xnn 0xnn 0xnn
	Time Counter (=last+64)	
Octet 8-11	RTP Sync Source	0x45 0xmm 0xnn 0xoo
	ID of the Radio (last 4 MAC digits)	

The above octets were arranged so that a third party program that supports RTP audio protocol could already use the packets from the RX-400A.

Additional header information is included that is specific to the RX-400A.

Octet 12-15	Sampling Frequency	0x00 0xmm 0xnn 0xoo
	MSB first. e.g. if sampling frequency is 54081 the value returned would be 0x00 0x00 0xd3 0x41. Because the RX400 sample rate is related to filter selection this will change when filters are changed.	
128 octets	Audio Data	0xnn…
	The audio data samples are two octets long and there are 64 of them. Format is 2 octets per sample MSB first.	

There are two commands to start and stop the RIP process.

Stop Ethernet RIPing	*E0<cr>
Start Ethernet RIPing	*E1<cr>

9.0 MAINTENANCE

9.1 FACTORY SERVICE

The RCU-400A Receiver Control Unit is designed to provide reliable service, however, should non-recoverable faults or equipment failure occur it is recommended the unit be returned to TEN-TEC, Inc. for repair. The TEN-TEC Service Department provides quick turn-around for most repairs. RMA numbers are not required. You may contact TEN-TEC to arrange for service at: (865) 428-0364. Hours are 8:00AM-5:00PM, Monday through Friday. Or send e-mail to: service@tentec.com

If known please indicate the nature of the fault or defect. Also include return shipping address and any special instructions related to marking or packing.

9.2 CLEANING AND LUBRICATION

Panel surfaces may be cleaned using a soft damp cloth and a mild detergent solution. *Never use caustic cleaners or any type of solvent as this may damage painted and chem-treated surfaces and plastic parts and knobs.*

9.3 INSPECTION

The RCU-400A Receiver Control Unit should be checked for external damage or component wear periodically. This should include inspection of the front panel phone jack for looseness, proper power switch operation, Main tuning and volume control knob tight on it's shaft and properly functioning pushbutton switches. Also check the LCD display for cracks, inoperative backlighting and missing alphanumeric screen data. Any time the unit is out of the rack console or if access is available to the rear of the RCU, the rear panel connectors should be checked for damage or looseness.

9.4 PERFORMANCE VERIFICATION AND FAULT ISOLATION

User level maintenance is limited to those tests that can be made at the operator position. Performance verification consists of normal operation of the unit, that is, the RCU seems to exhibit correct control functions and displays relative to RX-400A receiver operation to include detection mode selections match the signal demodulation, IF bandwidth selections result in expected audio response results without distortion and that audio outputs are present. It is also useful to check for proper operation of manual tuning, F1-F2 scan mode and memory channel scan mode along with RF gain, squelch and BFO function.

10.0 PREPARATION FOR SHIPMENT OR STORAGE

10.1 STORAGE

If the RCU-400A Receiver Control Unit is not going to be used for an extended period of time (in excess of 30 days) it should be stored in its sealed shipping carton or equivalent container. The unit is rated for storage temperatures from –40 to +70 degrees C. To prepare the unit for storage perform the following steps:

1. Remove all cords or cables attached to the unit.

2. Ensure there is sufficient bubble wrap or packing material in the container.

3. Place the unit in the center of the packing material.

4. Place packing material on top of the unit and seal the container.

5. Fasten labels or stamps and with indelible ink, write the word FRAGILE on all sides of the container. Also write the model number, nomenclature, quantity and serial number on the top of the container.

10.2 PREPARATION FOR SHIPMENT

If the RCU-400A is required to be shipped to another location or back to the factory for service, perform the steps in 10.1 above. Also include a packing slip, any pertinent instructions or purchase order paperwork inside the container on top of the packing material. Affix a shipping label to the outside of the container.